DOCUMENT RESUME

ED 201 804 CE 028 812

TITLE Safety Education Handbook. Volume 2.
INSTITUTION Kansas State Dept. of Education, Topeka.; Wichita Public Schools, Kans.
PUB DATE [80]
NOTE 671p.; For related documents see CE 028 811-813.

EDRS PRICE MF03/PC27 Plus Postage.
DESCRIPTORS Accident Prevention; Accidents; Athletic Equipment; Auto Mechanics; *Electrical Appliances; Electronic Equipment; Elementary Secondary Education; *Equipment; Fire Protection; Furniture; Graphic Arts; Home Furnishings; Infants; *Laboratory Safety; Metal Working; Plastics; Program Design; *Program Development; Safety; *Safety Education; *School Safety; Science Equipment; Self Evaluation (Groups); Stages (Facilities); Vocational Education; Welding; Woodworking

ABSTRACT

This is the second of three volumes of a safety guide developed to assist Kansas administrators and teachers in organizing, evaluating, and maintaining safety programs. It provides information to help them identify, assess, and correct unsafe conditions relating to equipment and facilities and ensure a safe and healthy environment for themselves and students. The guide delineates areas to be considered in designing effective, ongoing safety awareness programs and provides technical information regarding the systematic development of those programs. Instruments for self-evaluation, reporting, and record keeping are included for assessment purposes. This volume addresses safety as regards equipment/major appliances of these types: (1) auditorium/staging equipment, (2) industrial equipment (machine guarding, automatic equipment, electricity/electronic equipment), (3) graphic arts equipment, (4) metalworking equipment, (5) plastics equipment, (6) welding equipment, (7) woodworking equipment, (8) physical education/athletic equipment, and (9) science equipment. (YLB)

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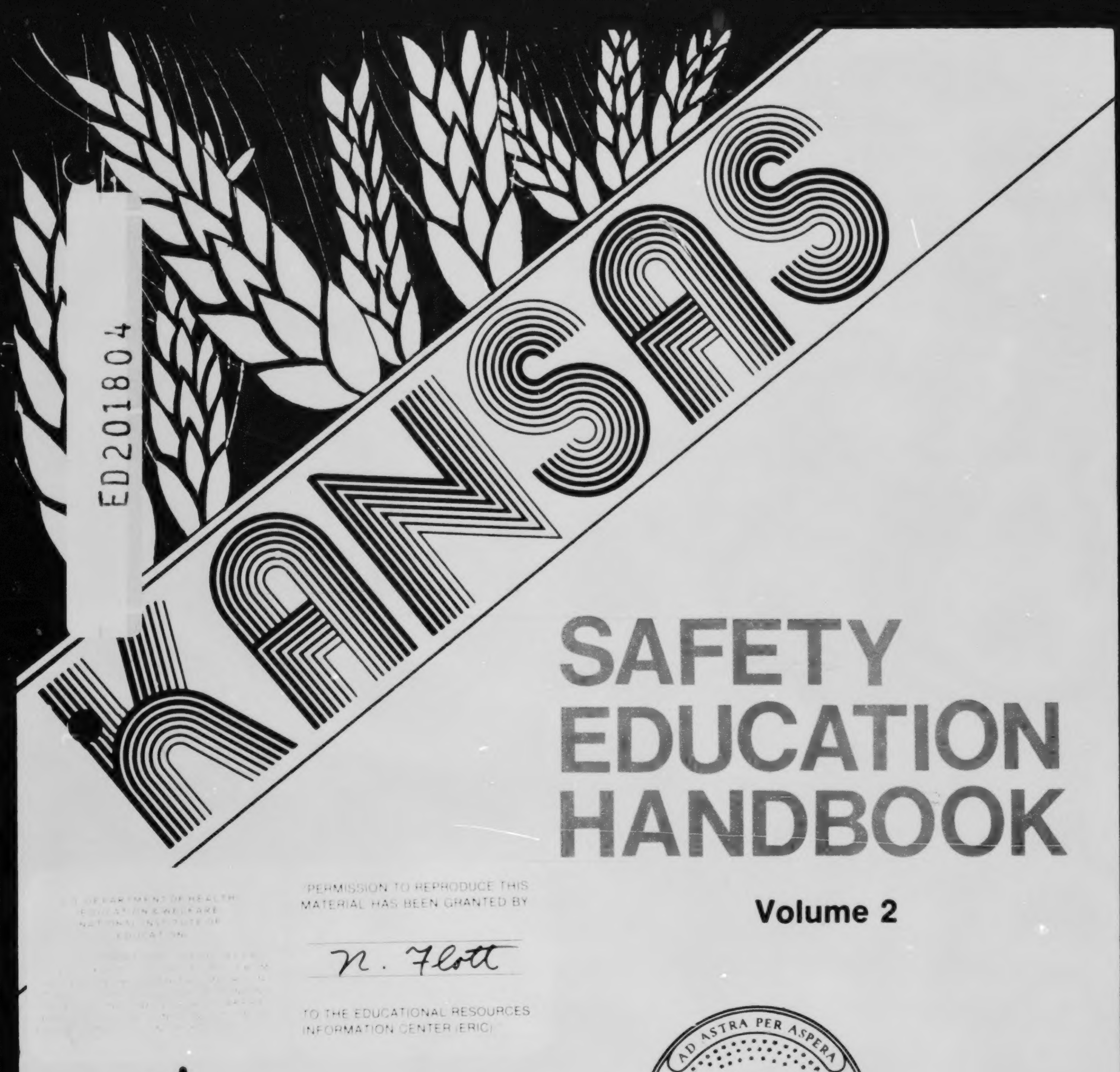

SAFETY EDUCATION HANDBOOK

Volume 2

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

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Kansas State Department of Education
in Cooperation with the
Wichita Public Schools, U.S.D. 259
Wichita, Kansas

STATE BOARD OF EDUCATION OF KANSAS · 1969

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WICHITA AREA VO-TECH SCHOOL
GRAPHIC ARTS CENTER
WICHITA, KANSAS

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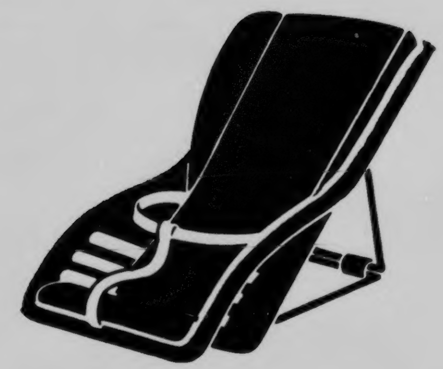
Baby Carriers



Baby carriers are convenient for feeding a baby, and for carrying him comfortably from place to place.

Carriers let infants feel a part of the activity going on around them.

But they can be dangerous. There are approximately 1,000 injuries related to baby carriers treated in hospital emergency rooms each year. Falls are common. A wide sturdy base may save a trip to the hospital.

SOME SAFETY TIPS:

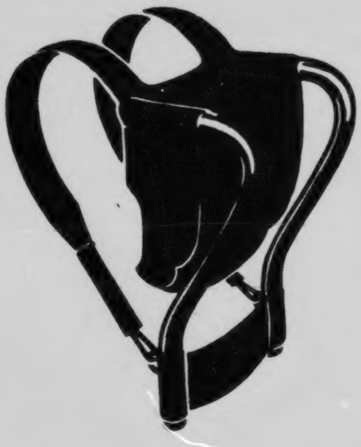
1. Stay within arm's reach of the baby when the baby carrier is on tables, counters, couches, and chairs. Never turn your back. Slippery surfaces such as glass table tops can be especially hazardous.
2. To provide a non-skid bottom surface for the baby carrier, attach rough surfaced adhesive strips.

3. Always use seat belts.
4. Check supporting devices which snap on the back of the baby carrier. They can pop out, causing the carrier to collapse.
5. And remember--a baby carrier is not a substitute for a car seat.

A SAFETY CHECK LIST

1. Sturdy materials, firm supports.
2. Wide base for stability.
3. Safety strap.
4. Non-skid bottom surface.

Back Carriers



Hiking, walking, shopping--how can you do all these things while carrying a baby? Wear an infant back carrier! But remember, framed back carriers should not be used before a baby is 4-5 months old. The baby's neck is then usually strong enough to withstand jolts that could cause injury to the neck.

SOME SAFETY TIPS:

1. Buy it to match the baby'size and weight. Try it on with the baby in it and check for:--Enough depth to support the baby's back--Leg openings small enough to prevent the baby from slipping out--Leg openings big enough to avoid chafing the baby's legs.
2. Restraining straps are essential! Children may stand up, and may try to climb out of frame carriers.
3. Look for sturdy materials with strong stitching or large, heavy duty snaps to prevent the baby from slipping out.
4. Avoid joints that may accidentally close and pinch or cut the baby.
5. Avoid sharp points, edges or rough surfaces.

6. Look for a back carrier with soft, padded covering over the metal frame near the baby's face. Bumping against the frame may cause injury to the head or face.

7. Check the carrier periodically for ripped seams, missing or loose snaps, frayed seats, or straps. Repair promptly!

8. When leaning over or stooping, bend from the knees rather than the waist to minimize the chances of the baby falling our of the back carrier.

A SAFETY CHECK LIST

1. Choose a carrier to match baby's size.
2. Sturdy material with strong stitching and heavy-duty snaps.
3. No joints that may close and pinch or cut.
4. No sharp points and edges, rough surfaces.
5. Padded soft covering over metal frame near baby's face.
6. Safety Strap.

Non-Standard Size Cribs

Full-size cribs have been made safer--and now, so have non-full-size cribs.

Federal regulations went into effect on August 10, 1976 governing non-full-size cribs, including portable cribs, crib pens, specialty cribs, undersize and oversize cribs. These cribs must now meet requirements similar to those for standard size cribs, and must have a label stating that they meet U. S. Consumer Product Safety Commission regulations.

SOME SAFETY TIPS:

1. The distance between crib slats should not be more than 2 3/8 inches.
2. The mattress should fit snugly to prevent entrapment. Babies have suffocated when wedged between the mattress and the crib. When a mattress is pushed against the side of the crib, there should not be a gap of more than one inch at any point between the edge of the mattress and the crib sides. When the crib is not accompanied by its own mattress, choose one according to the caution statement on the inside of the crib. The label indicates the correct size mattress for that particular crib.

3. The crib side should be high enough to prevent falls. When the mattress support is in its lowest position and the side is in its highest position, the side should measure at least 22 inches. When the mattress support is in its highest position and the side is in its lowest position the side should measure at least 5 inches.

4. All wooden surfaces should be smooth and free of splinters.

5. All hardware should be free of rough or sharp edges.

6. Latches on drop sides and folding sides or the crib should hold tightly enough to prevent accidental release. They should require either two actions to open and close, or at least ten pounds of force.

Remember--non-full-size cribs first entering the marketplace before August 10, 1976 may still be available for sale and may not meet the safety requirements. Also, mesh, net and screen cribs, bassinets, car beds and cradles are not affected by the requirements.

So be wise--look for safety features when choosing your baby's crib. And use the crib only until the child is 35 inches tall--and prevent a fall.

A SAFETY CHECK LIST:

1. No more than 2 3/8 inches between slats(roughly width of 3 adult fingers).
2. No rough or sharp edges.
3. Latch for drop or folding sides which cannot be accidentally released.
4. Crib sides high enough to prevent falls.
5. Snug-fitting mattress.

Standard Size Cribs

The U.S. Consumer Product Safety Commission has estimated that 150 to 200 infants die every year in accidents involving cribs. Many of the tiny victims had wiggled feet first through the crib slats until their heads were caught.

A Federal standard became necessary. In November 1973, CPSC issued regulations to make new full-size cribs safer. The regulations became effective February 1, 1974. They require a spacing of not more than 2 3/8 inches between crib slats. Until January 31, 1976, manufacturers had to display a label on new full-size cribs indicating that they met these standards. When selecting a crib now, though you may not find a label, the crib may still be safe to use. So check for safety features.

Use a mattress that fits snugly. Two fingers between the mattress and the crib side is a test. If you can accomplish this, the mattress is too small. Babies can suffocate if they become wedged between the mattress and the crib sides.

Buy a crib with as large a distance as possible between the top of the side rail and the mattress support. This will discourage the baby from climbing out.

Prevent falls. Make sure locks and latches on the dropside of the crib are secure. Metal hardware on the crib should be smooth. There should be no rough edges or exposed bolts on which the child can be injured.

SOME SAFETY TIPS:

1. Remove and destroy all plastic wrapping materials. Before throwing the materials away, tie them in knots. (Children have suffocated while playing with plastic wrap.)
2. Until you can replace a mattress that does not fit snugly, roll large towels and place them between the mattress and the crib sides. If the slats are more than 2 3/8 inches apart, install bumper pads. Bumper pads should extend around the entire crib and tie into place with at least six straps.
3. As soon as the child can stand up, lock the side rail at the maximum height and adjust the mattress to the lowest position. Remove bumper pads, large toys and boxes--an active toddler will use anything for climbing out of the crib.
4. If the height of the crib side is less that 3/4 of the child's height, the toddler has outgrown it and should sleep in a bed. Remember, a crib is not a playpen.

A SAFETY CHECK LIST

1. No more than 2 3/8 inches between the slats (roughly width of 3 adult fingers).
2. Snug fitting mattress.
3. Crib sides which lock at maximum height.
4. No rough hardware.
5. Latching device for dropside which cannot be easily released.

High Chairs

Thousands of injuries associated with high chairs are treated in hospitals emergency rooms each year. The vast majority of these injuries result from falls--sometimes the tray disengages when the toddler is leaning or pushing against it and the child falls out. The child can topple from the high chair when standing, climbing, or reaching. Sometimes the child falls when the tray itself is used in an attempt to restrain the child instead of seat belts.

SOME SAFETY TIPS:

1. When selecting a high chair, choose one that has a wide base for stability, It should feature safety straps which are not attached to the tray. Avoid hardware with rough edges or sharp points.
2. Always use seat belts.
3. Do not allow the child to climb into the chair alone.
4. Use the high chair in an area free of traffic--away from doorways, refrigerators, ranges and other kitchen equipment.

5. Check the tray each time it is used to see that it is properly latched to both sides.

6. Supervise the child closely, and instruct other children not to pull on the high chair or climb up on it.

A SAFETY CHECK LIST:

1. Stability--wide base.

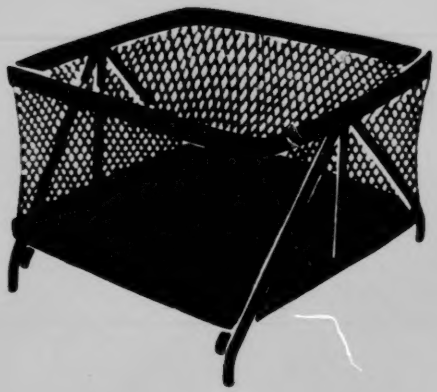
2. No sharp or rough edges.

3. No sharp points.

4. Restraining straps not attached to the tray.

5. Tray which locks securely.

Playpens



When the toddler can climb over the side of the playpen, it is time to allow him to roam free of it.

Accidents do happen, however, well before the child can perform this feat. The child may fall when trying to climb out of the playpen.

Mesh playpens with large open weave netting provide an easy toehold for climbing.

Buttons and snaps on the child's clothing may catch on large weave mesh netting. A toddler can strangle if he falls down with a button snagged on the netting. Fingers can be pinched in hinges when the playpen does not lock properly. Protruding bolts and rough edges cause cuts, scratches, and bruises.

SOME SAFETY TIPS: When you are selecting a playpen, check for the following features.

1. Wooden slats which are no more than 2 3/8 inches apart.
2. Hinges and latches on folding models which lock tightly to prevent scissoring action when the playpen is in use.

3. A firm floor support to prevent collapse of playpens with legs.

4. Foam pads--they are long lasting and don't mildew.

5. Mesh netting with a very small weave--smaller than tiny buttons on a baby's clothing.

When using the playpen:

1. Take it inside after use outdoors. Rust, water, and sun can damage the playpen.

2. If spacing of slats is more than 2 3/8 inches, interweave sheeting between the slats and fasten securely.

3. Remove large toys, bumper pads, or boxes from inside the playpen. They can be used for climbing.

4. Avoid tying decorative items across the top of the playpen since they can also be used for climbing.

5. If toys are hung from the sides, the cord should be no longer than 12 inches--short enough that it won't wrap around the child's neck.

A SAFETY CHECK LIST

1. Not more than 2 3/8 inches between the slats.

2. Hinges on folding models should lock tightly and should have no sharp edges.

3. Firm floor support on playpens with legs to prevent collapse.

4. Foam pads.

5. Mesh netting with very small weave--smaller than tiny buttons.

Strollers and Carriages

Your baby can help you judge the stroller that is the safest buy.

Take the child along on your shopping trip and let him have a seat in each of the strollers you are considering.

Your baby will enjoy the ride if the backrest is firm and vertical, or nearly so, and if the seat is flat and firm. There should be enough "headroom" for growth when the canopy is attached.

SOME SAFETY TIPS:

1. Test strollers and carriages for stability.
2. The base should be wide enough to prevent tipping, even when the baby leans over the side. If it can be adjusted to a reclining position, be sure it does not tip backward when the baby lies down.
3. Wheels should be large enough in diameter to provide stability.

4. Do not overlook canopies and shopping baskets attached to strollers. They, too, can affect stability.

   - The canopy should lock in a forward horizontal position. When it is unlocked, it should rotate to a downward position in the rear of the stroller.

   - The shopping basket for carrying packages should be low on the back of the stroller, and located so that its center is in front of (or directly over) the axle of the rear wheels.

5. When using the stroller or carriage:

   - Check latching devices--make sure they are securely fastened.

   - The brake should operate properly.

   - Always use seat belts.

   - Do not allow another child to stand in the basket.

   - Supervise the child.

A SAFETY CHECK LIST

1. Place child as far to the rear of the stroller as possible to see if it tips.

2. Backrest--vertical, or nearly vertical for firm support.

3. Safety belt.

4. A brake which locks tightly. A two wheel brake provides an extra measure of safety.

5. No sharp edges or scissor-like mechanism.

6. Headroom for growth when the canopy is down.

7. Wide base and wheels which are large in diameter.

8. Canopy which locks in forward horizontal position and rotates to downward position at rear.

9. Shopping basket low on the back and located so that its center is directly over or in front of axle of rear wheels.

Baby Walkers

Walkers provide exercise for a baby, and may help to protect the child who is learning to walk.

But they must be selected carefully and used safely, because there are hazards, and accidents can happen.

SOME EXAMPLES:

Tipping Over--when the child is maneuvering over thresholds and rugs; when leaning, reaching, or running in the walker.

Finger Entrapment--in the older x-frame walkers--when the walker partially collapses.

Falling Down Stairs--when caretakers (parents and babysitters) assume the infant is safe in the walker, and leave doors open and stairs unguarded.

SOME SAFETY TIPS:

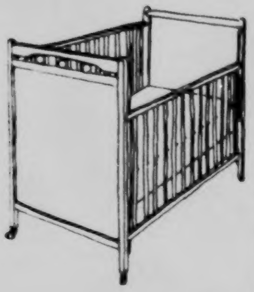
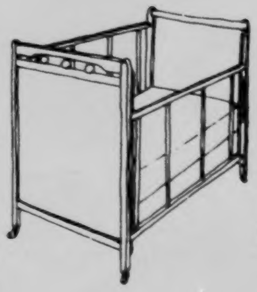
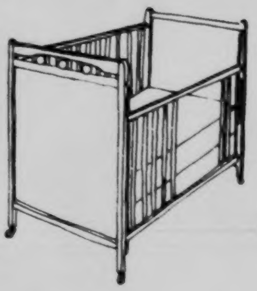
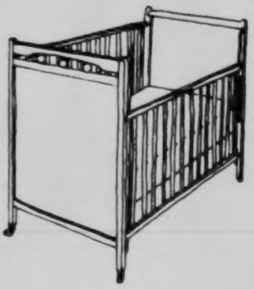
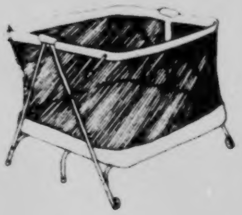
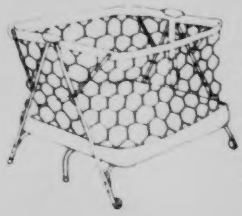
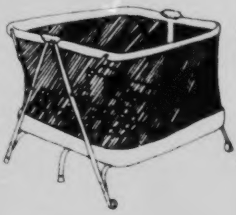
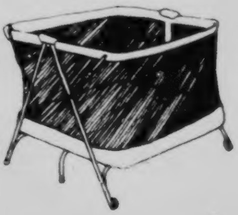
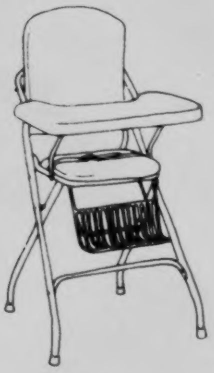
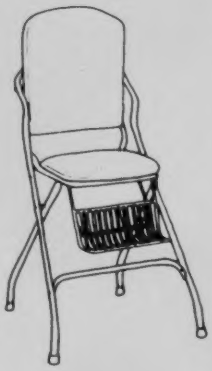
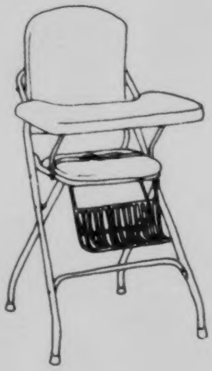
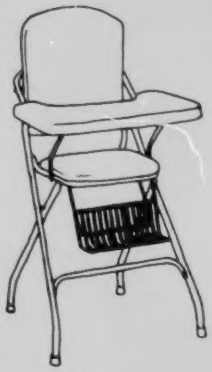
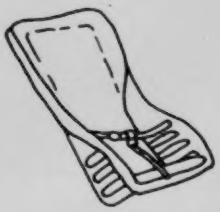
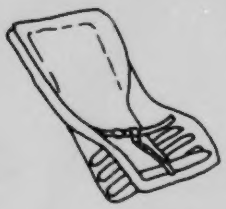
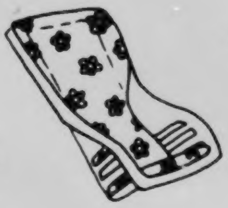
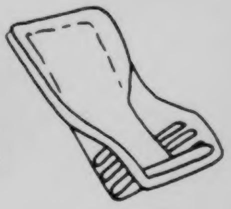
1. Select a walker that is stable. The wheel base should be both wider and longer than the frame of the walker itself. Small, flimsy wheels or a narrow base can contribute to tipping. Be sure the seat is made of sturdy materials--unbreakable plastic or tough fabric with heavy duty stitching or large rugged snaps.
2. Look for protective covers for coiled springs and hinges. Locking devices and screws should have no sharp edges or points.
3. When the baby walker is in use, assist the child in maneuvering on and off carpeting, across thresholds, and around furniture.
4. Remove throw rugs. Loose rug fibers can become entangled in the wheels.
5. Place guards at the top of all stairways, or keep stairway doors closed to prevent falls.
6. Above all, be aware of what the child is doing. The unattended toddler is too often an accident victim.

A SAFETY CHECK LIST

1. Stability--the wheel base should be both wider and longer than the frame of the walker.
2. Sturdy materials--unbreakable plastic or tough fabric seats with heavy-duty stitching or large rugged snaps.
3. Protective covers over coil springs and hinges.

Which is the safest?

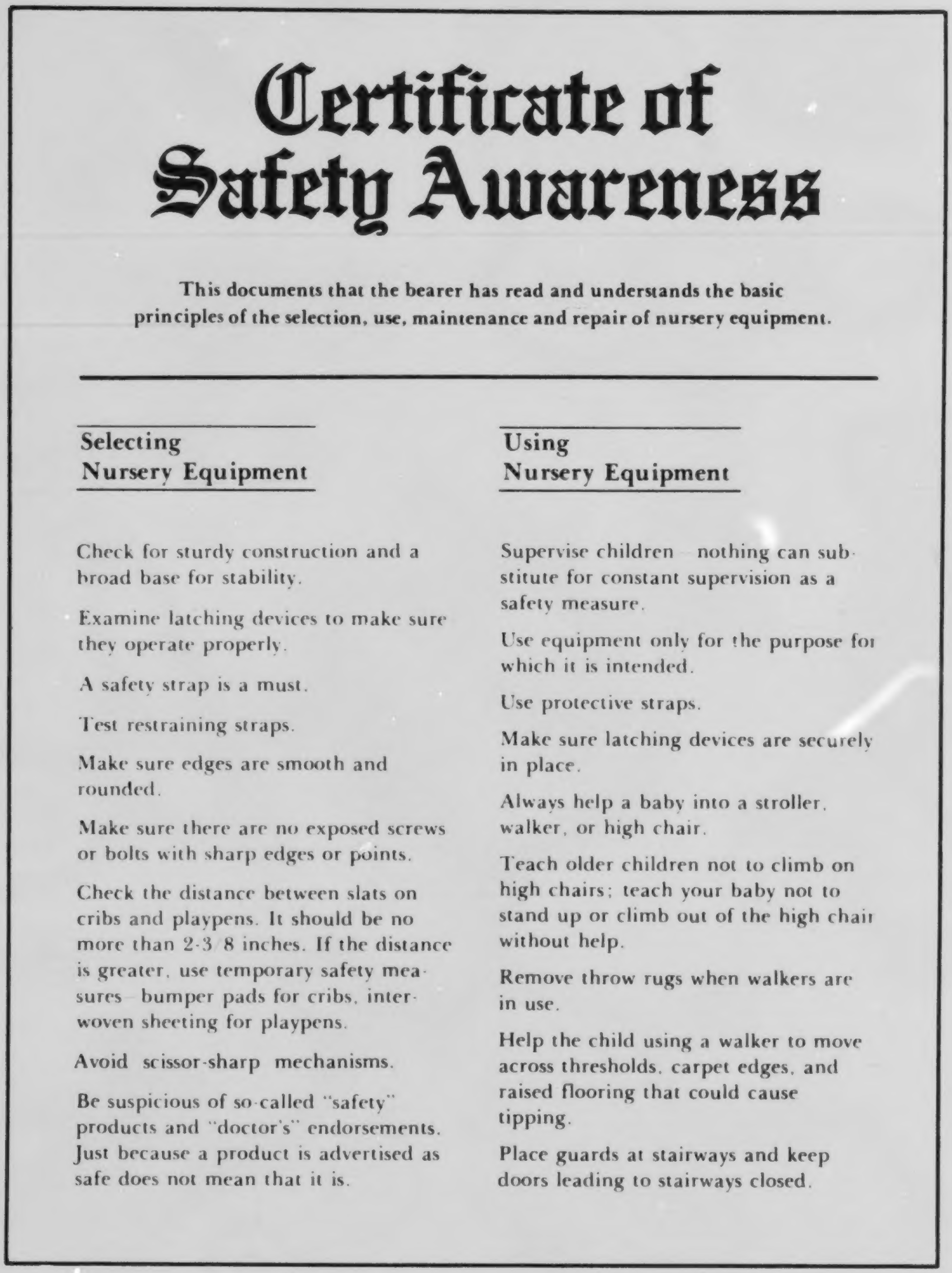
On the left are drawings of four items of nursery equipment. Across from each are three drawings. Circle the safest on the right.

What's Most Important?

There are 3 possible answers to the right. Circle the number next to the correct answer.

Bumps is going for a ride in a stroller. What is most important?	*1. Brush Bumps' hair.* *2. Give Bumps a toy.* *3. Fasten the seat straps.*
Bumps is lying in a crib. What is most important?	*1. Give the baby a pacifier.* *2. Sing a song.* *3. Remove boxes and large toys.*
Bumps is put in a baby carrier. What is most important?	*1. Fasten the seat straps.* *2. Give Bumps a rattle.* *3. Go get a bottle for Bumps.*
Bumps is in a high chair. What is most important?	*1. Feed Bumps.* *2. Lock the tray.* *3. Wipe Bumps' hands.*
Bumps is in a baby walker. What is most important?	*1. Push Bumps.* *2. Play "pat-a-cake."* *3. Remove throw rugs.*



Certificate of Safety Awareness

This documents that the bearer has read and understands the basic principles of the selection, use, maintenance and repair of nursery equipment.

Selecting Nursery Equipment

Check for sturdy construction and a broad base for stability.

Examine latching devices to make sure they operate properly.

A safety strap is a must.

Test restraining straps.

Make sure edges are smooth and rounded.

Make sure there are no exposed screws or bolts with sharp edges or points.

Check the distance between slats on cribs and playpens. It should be no more than 2-3/8 inches. If the distance is greater, use temporary safety measures—bumper pads for cribs, interwoven sheeting for playpens.

Avoid scissor-sharp mechanisms.

Be suspicious of so-called "safety" products and "doctor's" endorsements. Just because a product is advertised as safe does not mean that it is.

Using Nursery Equipment

Supervise children—nothing can substitute for constant supervision as a safety measure.

Use equipment only for the purpose for which it is intended.

Use protective straps.

Make sure latching devices are securely in place.

Always help a baby into a stroller, walker, or high chair.

Teach older children not to climb on high chairs; teach your baby not to stand up or climb out of the high chair without help.

Remove throw rugs when walkers are in use.

Help the child using a walker to move across thresholds, carpet edges, and raised flooring that could cause tipping.

Place guards at stairways and keep doors leading to stairways closed.

FILL IN THE BLANKS

1. *When Bumps is in a high chair, the __ __ __ __ must be locked tightly and the __ __ __ __ __ __ must be fastened around the baby.*
2. *When Bumps is in a baby walker, the base should be __ __ __ __ for stability.*
3. *When Bumps is riding in a stroller, the __ __ __ __ __ __ must be buckled around the baby.*

Hat

Straps

Blanket

Tray

Jacket

Toys

Wide

ANSWERS: Infant Furniture Quizzes

Which Is The Safest?

Crib with closely spaced slats.

Playpen with mesh which is a small weave.

Highchair with tray and restraining straps.

Carrier with straps.

What's Most Important?

3. Fasten the seat strap.
3. Remove boxes and large toys.
1. Fasten the seat strap.
2. Lock the tray.
3. Remove throw rugs.

Fill In The Blanks

1. tray, straps
2. wide
3. straps

MAJOR APPLIANCES
(DISHWASHERS)

DISHWASHER, COMMERCIAL

OPERATION PROCEDURES

1. Place scrap trays, wash arms and curtains in machine.
2. Close drain valves tightly.
3. Open fill valves and fill tanks to specified level.
4. Close fill valves.
5. Turn on heat for tanks, dish machine motor, and electronic equipment.
6. Add detergent and drying agent to reservoirs.
7. Do not wash dishes until all temperatures are correct:

Prewash	100° - 120° F
Wash	155° - 170° F
Rinse-power	165° - 180° F
Final rinse	180° - 195° F

8. Change tank water every 2-4 hours.
9. Scrape food from plates.
10. Sort and stack dishes.
11. Rack dishes of same size together.
12. Place cups, glasses, and bowls upside down in racks.
13. Soak flatware 15-20 minutes and wash twice.
14. Invert silver in baskets.
15. Allow dishes to air dry.
16. Remove and stack dishes and silverware in proper places.
17. Turn off machine motor and heaters.

CLEAN UP PROCEDURES

1. Pull scrap trays and remove curtains.
2. Clean trays with brush.

3. Run trays and curtains through dish machine.

4. Turn off dish machine.

5. Scrub down, rinse, and squeegee dish tables.

6. Drain machine.

7. Scrub tanks with brush while draining.

8. Hose down inside of machine.

9. Clean outside of soap dispenser and machine.

10. Fill tanks, allow water to overflow 2-3 minutes.

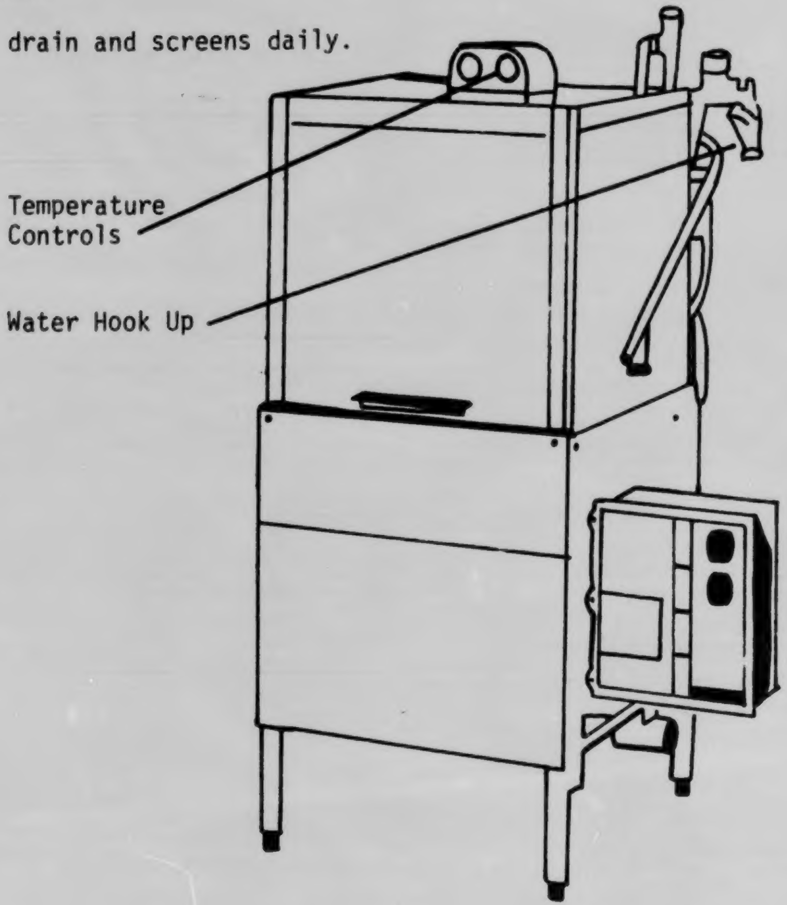
11. Replace scrap trays and curtains.

SAFETY PRECAUTIONS

1. Clean drain and screens daily.

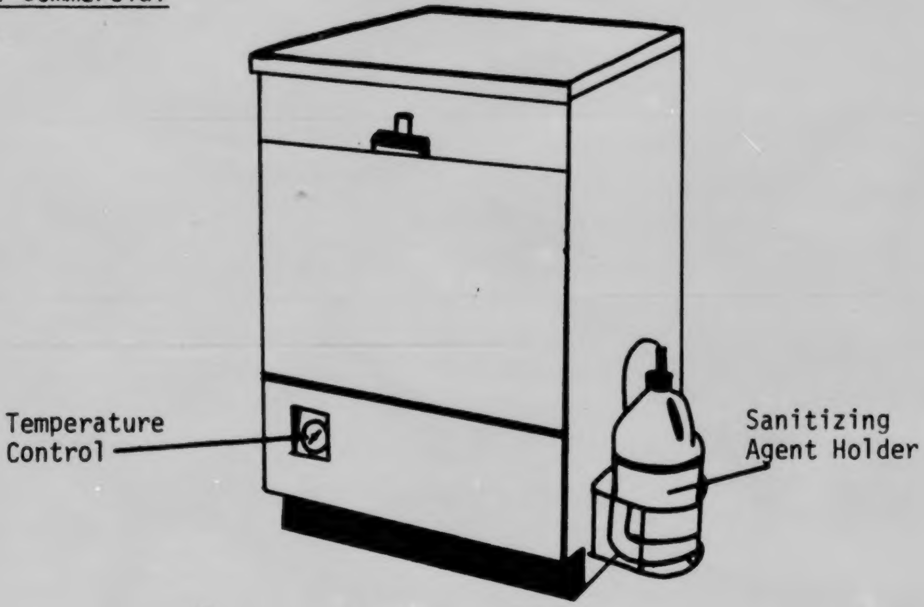
DISHWASHERS

Foot Flight

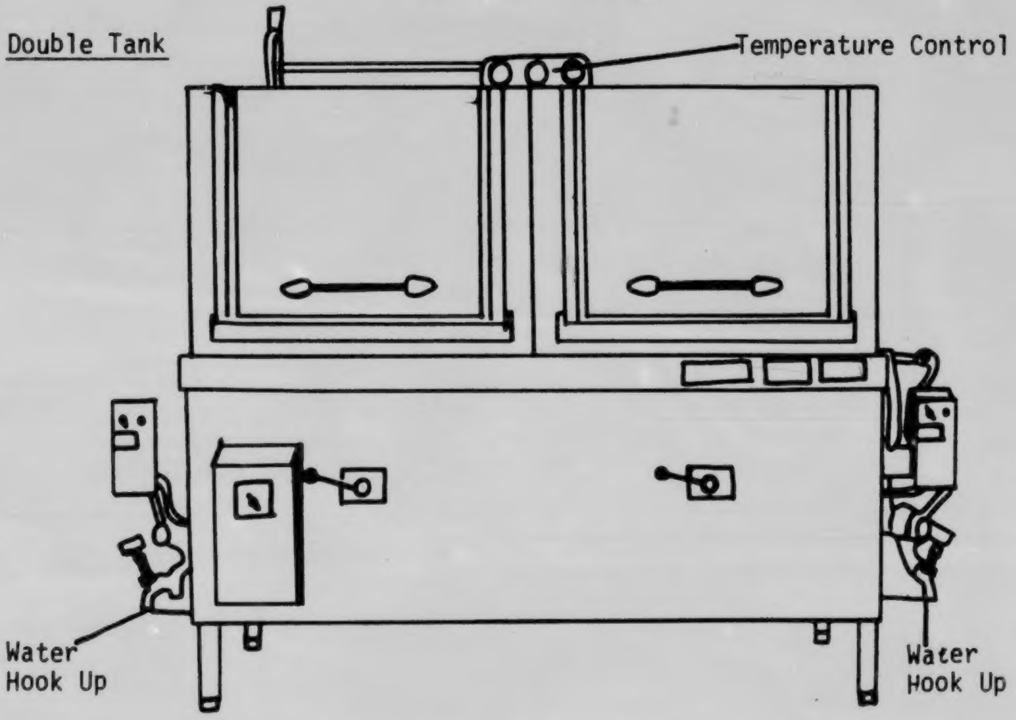


DISHWASHERS continued

Small Commercial

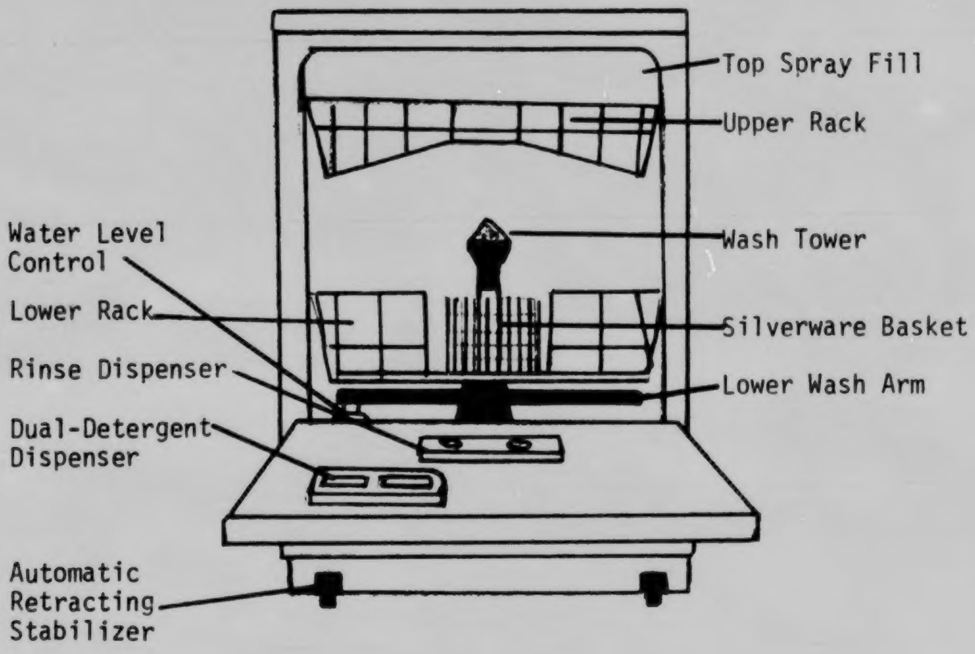

Temperature Control
Sanitizing Agent Holder

Double Tank


Temperature Control
Water Hook Up
Water Hook Up

499

DISHWASHER, HOME MODEL


Top Spray Fill
Upper Rack
Water Level Control
Wash Tower
Lower Rack
Silverware Basket
Rinse Dispenser
Lower Wash Arm
Dual-Detergent Dispenser
Automatic Retracting Stabilizer

SAFETY PRECAUTIONS

1. Do not touch heating element during or immediately after cycle is finished.
2. Load sharp knife handles UP.
3. Wash only dishwasher safe items.
4. Keep dishwashing detergents and wetting agent compounds out of reach of children.
5. When filling, rinse agent dispenser, take extra care to avoid spilling wetting agent.

SAFETY QUIZ

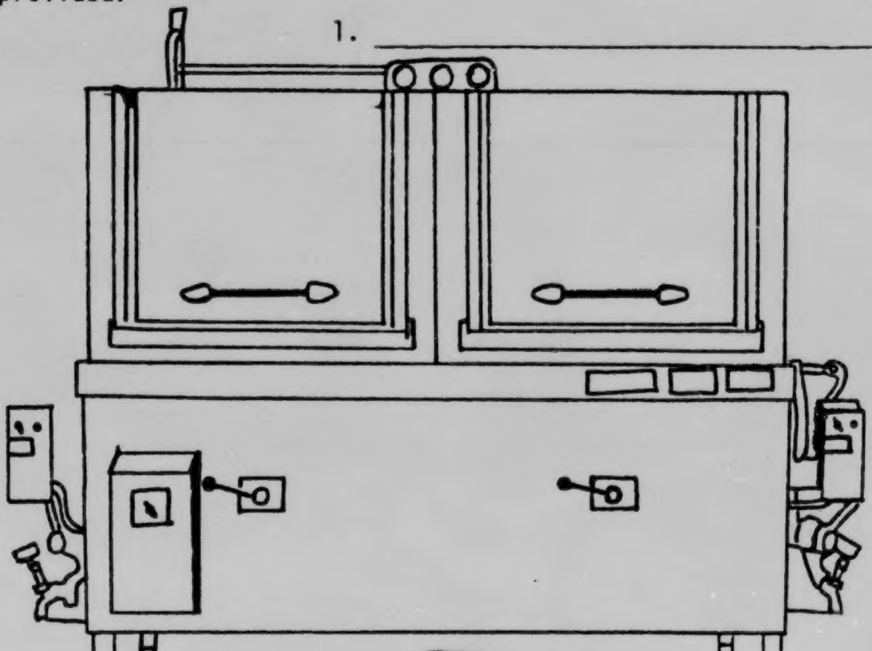
DISHWASHERS

Name ______________________________

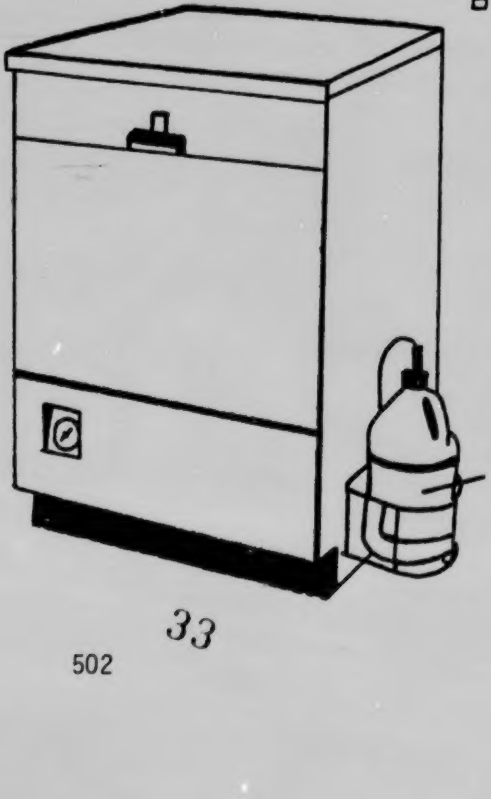
Date ______________________________

Identify each type of dishwasher by placing the correct name in the space provided.

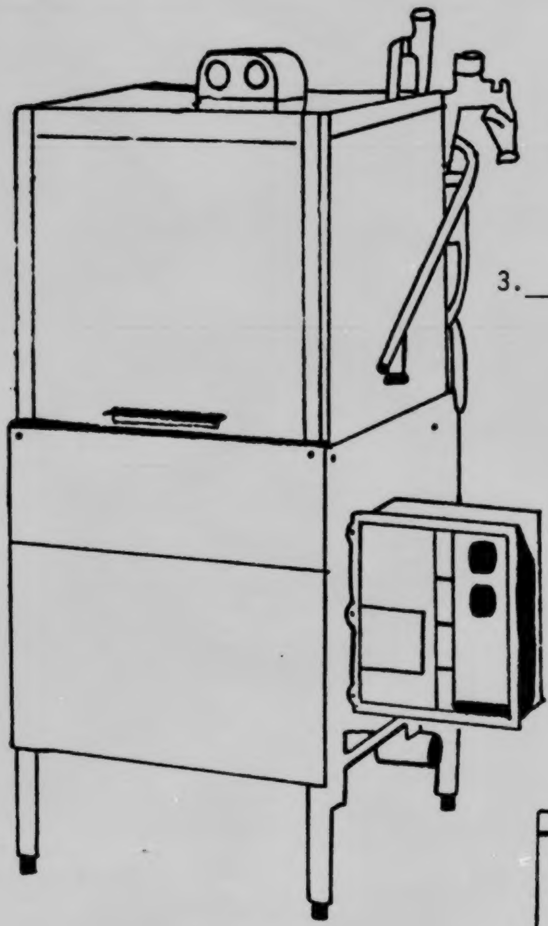
1. ______________________________



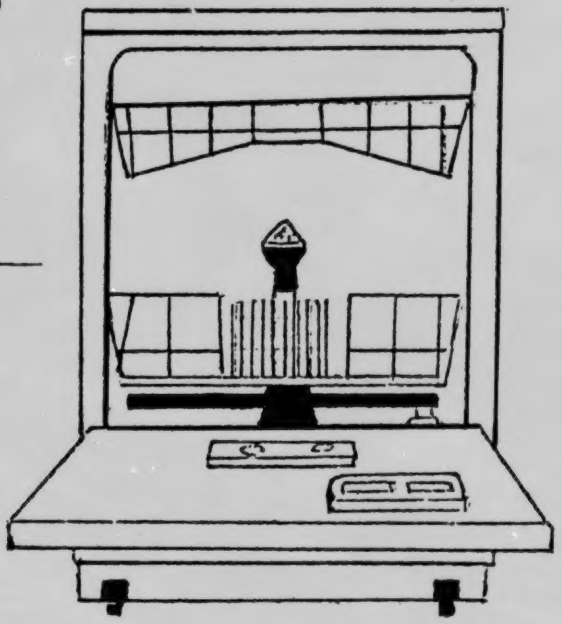
2. ______________________________



Safety Quiz: Dishwashers continued



3. ______________________________



4. ______________________________

FOOD COOKING EQUIPMENT

Salamander Broiler

OPERATION PROCEDURES

1. Preheat 15 minutes to high temperature before using.
2. Adjust temperature control.
3. Rub grid with oil if necessary to prevent sticking.
4. Shake off excess oil on food before placing on grid.
5. Place food on grid that has been adjusted for the degree of doneness desired.
6. Broil, turn and season.

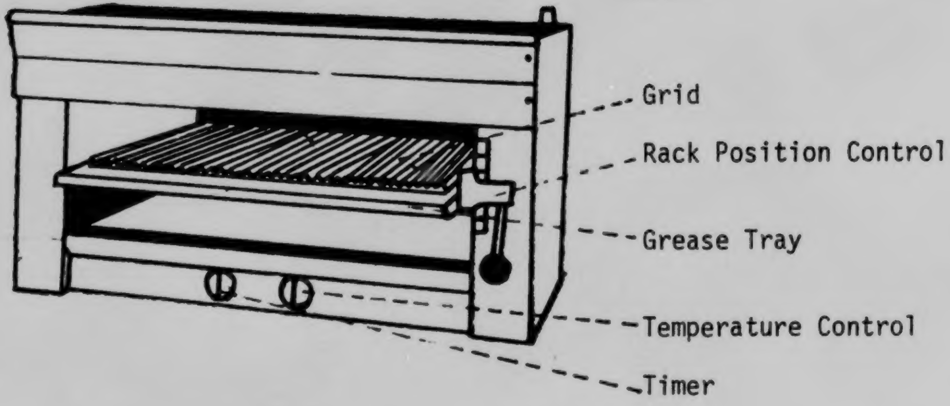
CLEAN UP PROCEDURES

1. Turn broiler off and allow to cool.
2. Remove grid and soak.
3. Scrape burned particles from broiler.
4. Remove grease tray and empty.
5. Scrub broiler grid and grease tray, rinse and allow to air dry.
6. Wipe inside of broiler, outside and top of broiler. Rinse and wipe dry.
7. Replace grid and grease tray.
8. Lock grid into position and test.

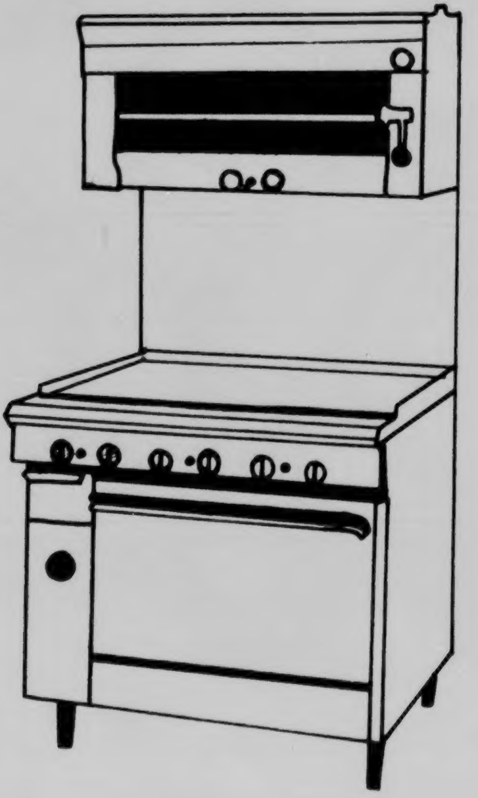
SAFETY PRECAUTIONS

1. Make sure grid position is locked before using.
2. When moving pans that might contain grease drippings use extra care.
3. Use under a vented hood.
4. Do not allow grease to build up, clean regularly.

COUNTER OR WALL MOUNTED


Grid
Rack Position Control
Grease Tray
Temperature Control
Timer

RANGE MOUNTED



Major Appliances: Char Broiler

OPERATION PROCEDURES

1. Preheat 15 minutes to high temperature before using.
2. Adjust temperature control to desired temperature.
3. Rub grid with oil to prevent sticking if necessary.
4. Shake off excess oil on food before placing on grid.
5. Locate grid at proper position for broiling according to degree of doneness desired.

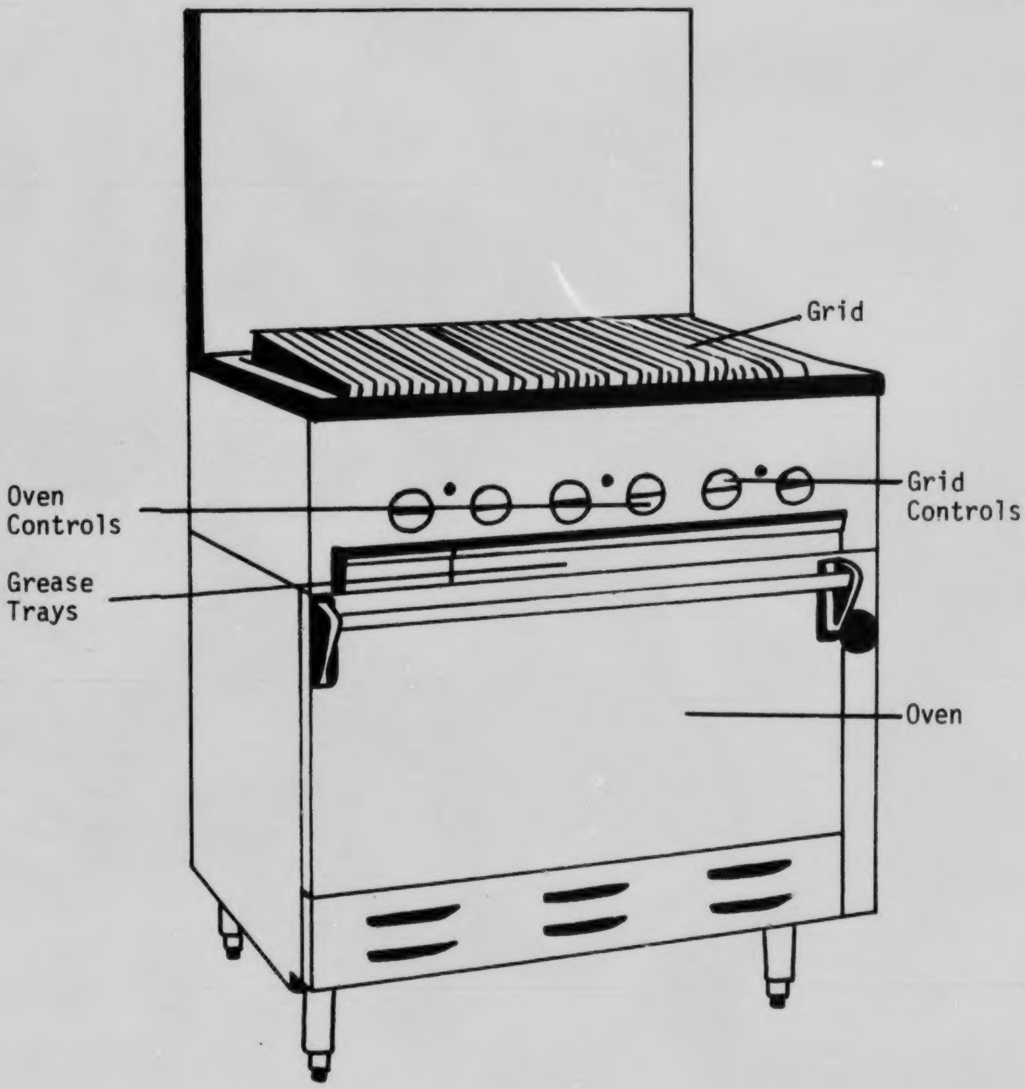
CLEAN UP PROCEDURES

1. Turn off broiler
2. Allow to cool
3. Remove grid
4. Soak grid
5. Scrape burned particles from side of broiler
6. Remove grease trays
7. Scrub grid and grease trays
8. Allow to air dry
9. Wipe inside of broiler
10. Wipe outside and top of broiler
11. Rinse and swipe try inside, outside and top
12. Replace grid and grease trays and lock into position

SAFETY PRECAUTIONS

1. Keep grill cleaned properly to prevent flash fires.
2. Use grill under a vented hood.
3. Keep grease trays emptied and cleaned.
4. Make adjustments on grid position carefully to prevent burns.

CHAR BROILER/OVEN


Grid
Oven Controls
Grid Controls
Grease Trays
Oven

Major Appliances: Deep Fat Fryer, Electric/Gas

The deep fryer is a large, automatic fry kettle that can be used to deep-fry all foods. It holds from 25-50 lbs. of shortening, and the temperatures range from 200° to 400° F.

OPERATION PROCEDURE

1. Close grease outlet.
2. Fill fryer with fat to level line indicator.
3. Set thermostat to 250° until fat is melted-about 10 minutes.
4. Set thermostat to desired temperature.
5. Place baskets on hook and fill with food.
6. Submerge baskets slowly into hot fat.
7. Shake baskets occasionally.
8. Hang baskets on hook to drain (10-15 seconds).
9. Remove food from baskets and drain on absorbent paper.
10. Turn heat off as soon as frying is complete.

CLEAN UP PROCEDURE FOR GAS FRYER

1. Allow fat to cool but not to solidify.
2. Drain and strain fat.
3. Fill deep fat fryer with hot machine detergent solution.
4. Scrub inside and outside of unit.
5. Place large pot below drain and open drain.
6. Rinse deep fat fryer thoroughly with clean hot water.
7. Wipe dry and refill fryer.
8. Cover.

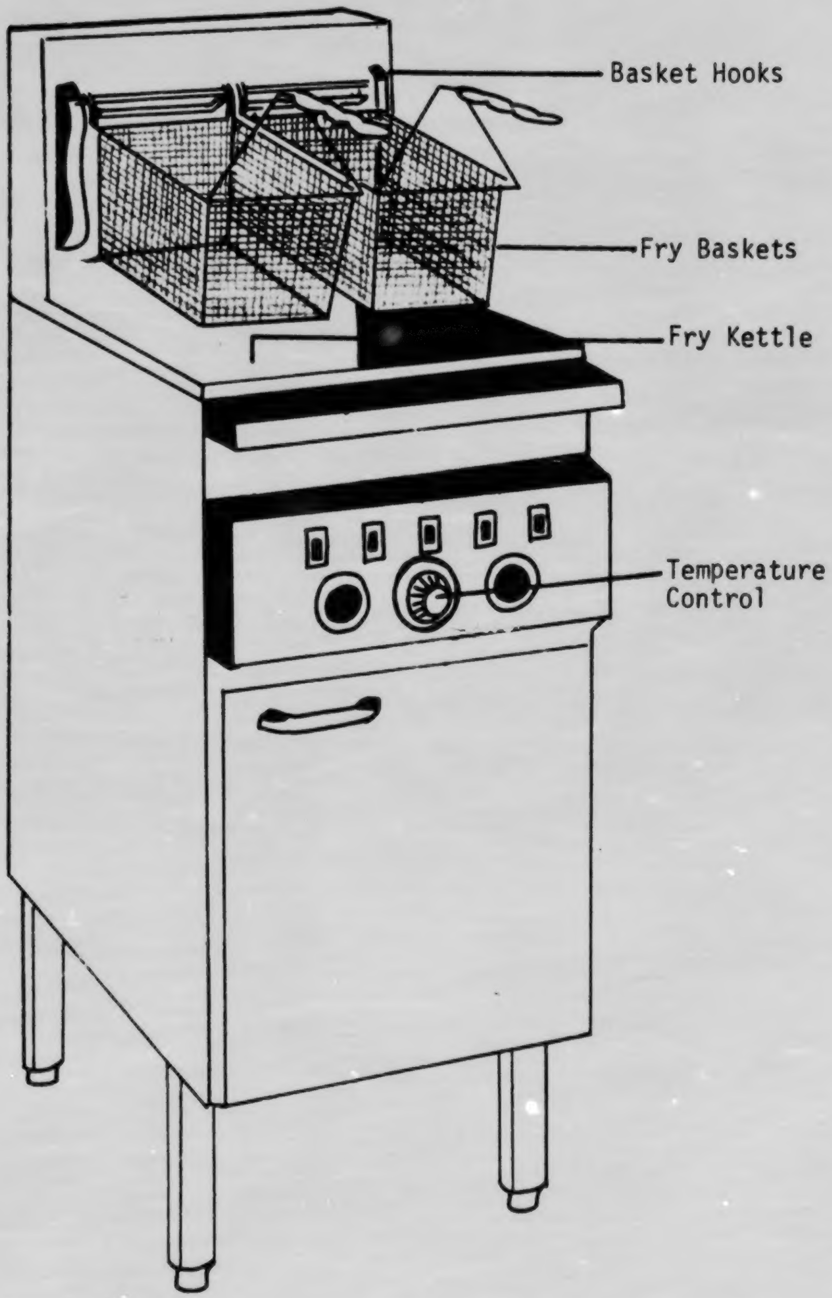
CLEAN UP PROCEDURE FOR ELECTRIC FRYER

1. Allow fat to cool but not to solidify.
2. Lift heating unit from fat and lock into position.
3. Turn on fryer to high temperature.
4. Pump fat from fryer through filter to clean container.
5. Remove soiled container from fryer and wash.
6. Turn off fryer and allow to cool.
7. Scrub outside of unit.
8. Place clean container with fat into unit.
9. Lower heating unit into fat.
10. Cover.

SAFETY PRECAUTIONS

1. Fat should not be heated over 400^{o} F.
2. When filling baskets, fill to no more than 2/3 full.
3. Submerge baskets slowly especially if frozen food to eliminate foaming and bubbling.
4. Avoid using the fryer if there are other people working close to it.
5. Never leave foods cooking in deep fat to attend to something else.
6. Do not drop foods in the fryer.
7. Do not remove items to an area behind you.
8. Do not allow fat to drip on the floor. If it does, clean it up immediately.
9. Before leaving establishment, recheck to make sure fryer has been turned off.
10. Keep melted fat to required level.
11. Keep drain plug closed tightly.

DEEP FAT FRYER, ELECTRIC/GAS


Basket Hooks
Fry Baskets
Fry Kettle
Temperature Control

Major Appliances: Griddle (Grill)

This appliance is used for broiling and quick cooking. Usually signal lights will indicate overheating. A built-in ventilation system draws off odors and smoke quickly. To prevent food flavors from mixing, the grill must be kept clean at all times.

OPERATION PROCEDURES

1. Preheat to 400° F.
2. Brush with thin film of cooking oil.
3. Allow oil to remain on grill for 2 minutes.
4. Wipe off surplus oil.
5. Turn temperature to desired temperature.
6. Place food items on surface according to recipe.
7. Clean surface of food particles and grease frequently.
8. Empty grease cups as they fill.

CLEAN UP PROCEDURES

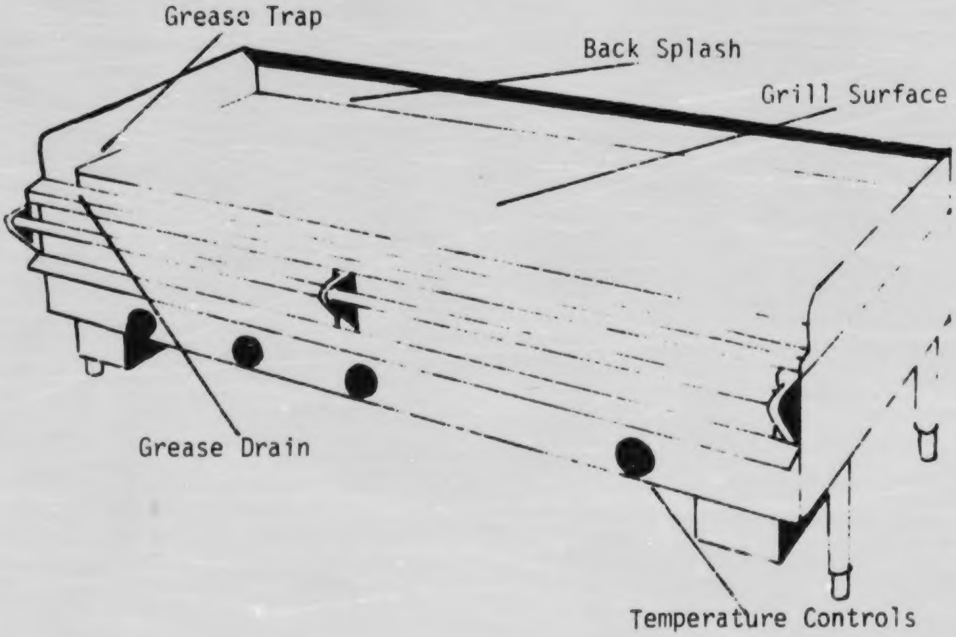
1. Turn heat off and allow grill to cool completely.
2. Remove food particles and grease with flexible spatula.
3. Remove grease trap, wash, rinse and let air dry.
4. Turn grill to low and rub with pumice stone, grill brick or grill screen.
5. Clean with a damp cloth, then wipe dry.
6. Season.
7. Replace grease trap.
8. Wash sides and back of grill, rinse and wipe dry.

SAFETY PRECAUTIONS

1. Remove any grease in grease traps before turning the heat on to eliminate a fire.
2. Never touch the grill to determine how hot it is.

3. Never drop water on grill to determine temperature.
4. Recheck before leaving to make sure heat is off.
5. Do not leave food frying to do another task.

GRIDDLE


Grease Trap
Back Splash
Grill Surface
Grease Drain
Temperature Controls

Major Appliances: Convection Oven

These ovens are sometimes referred to as air-flow oven. They are unique in that air in them is circulated throughout the interior by means of an electric fan. Because the heat is evenly distributed by the fan, this oven can be loaded to capacity with all foods receiving the same amount of heat.

The use of the convection oven will:

1. increase productivity
2. reduce shrinkage
3. cook more uniformly

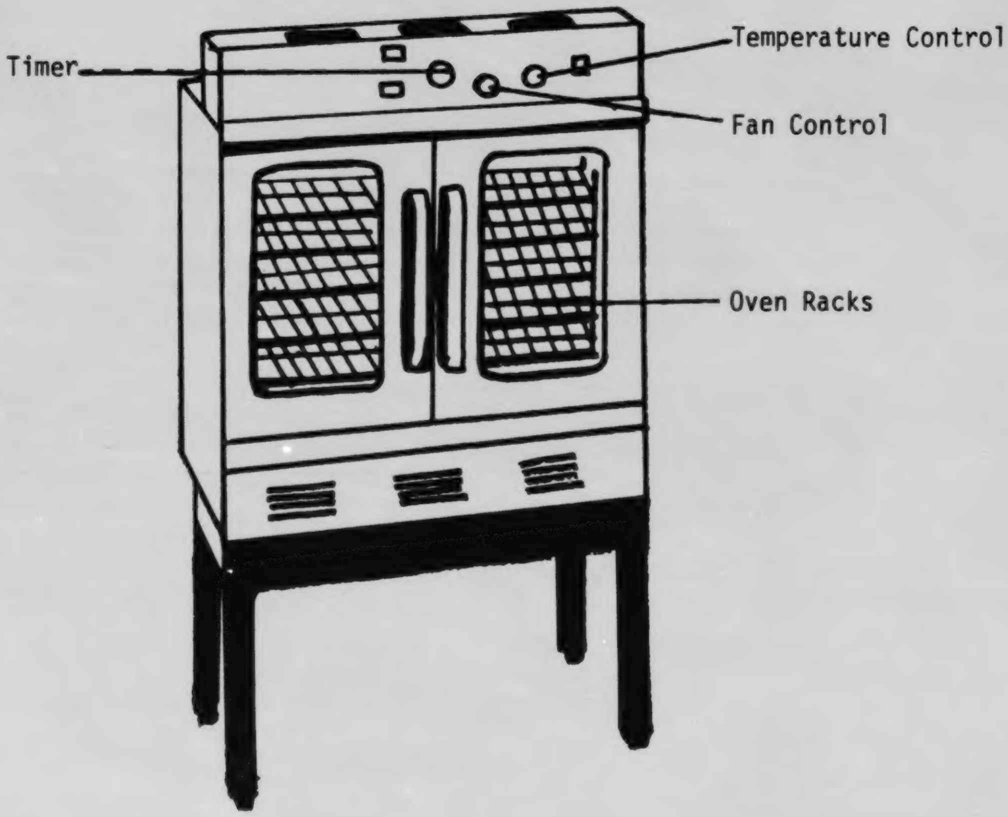
OPERATION PROCEDURES

1. Turn thermostat to desired temperature-decreasing 25^0-50^0.
2. Turn on fan.
3. Allow to preheat.
4. Load oven evenly.
5. Cook as directed on recipe.

CLEAN UP PROCEDURES

1. Turn off oven and allow to cool.
2. Scrape burned particles from oven.
3. Brush out inside of oven, shelf ledges, and door crevice.
4. Wash outside and frame.
5. Rinse and wipe dry.

CONVECTION OVEN


Timer
Temperature Control
Fan Control
Oven Racks

SAFETY PRECAUTIONS

1. Turn off fan before opening doors.
2. Turn off light when fan is operating.
3. If it's a gas powered oven, needs to be placed under a vent.
4. Do not use loose coverings on food as they blow around.

Follow precautions for kitchen range listed previously.

Major Appliances: Conventional Oven

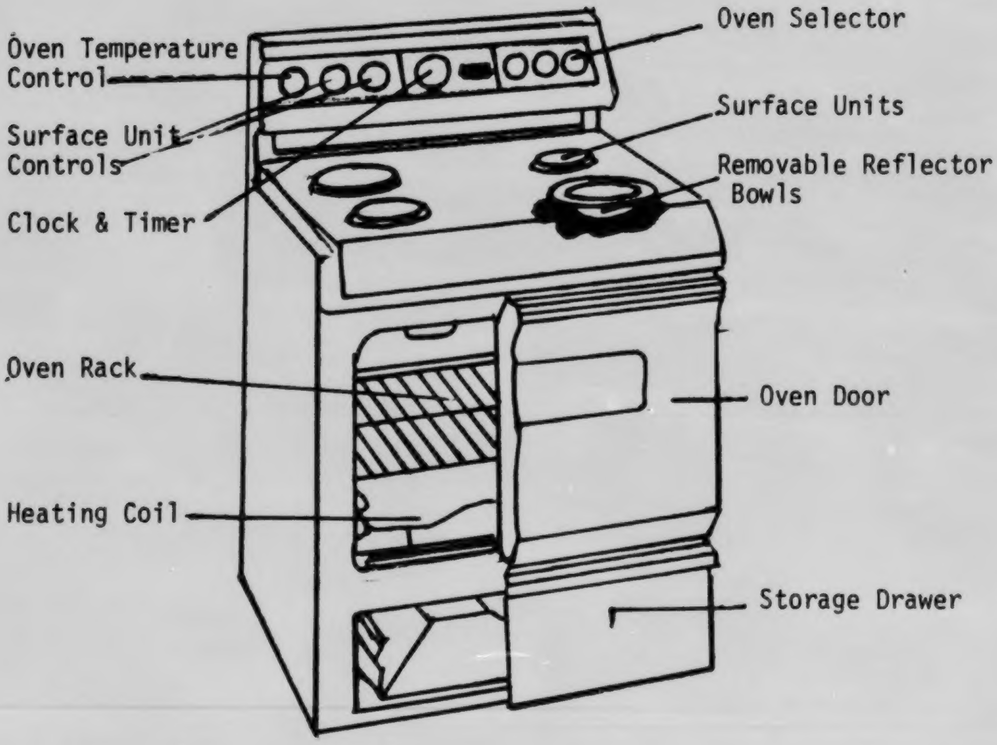
OPERATION PROCEDURES

1. Turn temperature control switch to medium or high.
2. Turn thermostat to desired temperature and allow to preheat.
3. Load oven evenly:
    - Pans 2 inches away from door.
    - Pans 2 inches away from each other.
    - Pans 2 inches away from oven walls.
4. Cook as directed on recipe.

CLEAN UP PROCEDURES

1. Turn oven off and allow to cool.
2. Scrape burned particles from inside of oven.
3. Brush out inside of oven, shelf ledges and door crevice.
4. Wash outside of door and frame.
5. Rinse and wipe dry.

CONVENTIONAL OVEN


Oven Temperature Control
Surface Unit Controls
Clock & Timer
Oven Rack
Heating Coil
Oven Selector
Surface Units
Removable Reflector Bowls
Oven Door
Storage Drawer

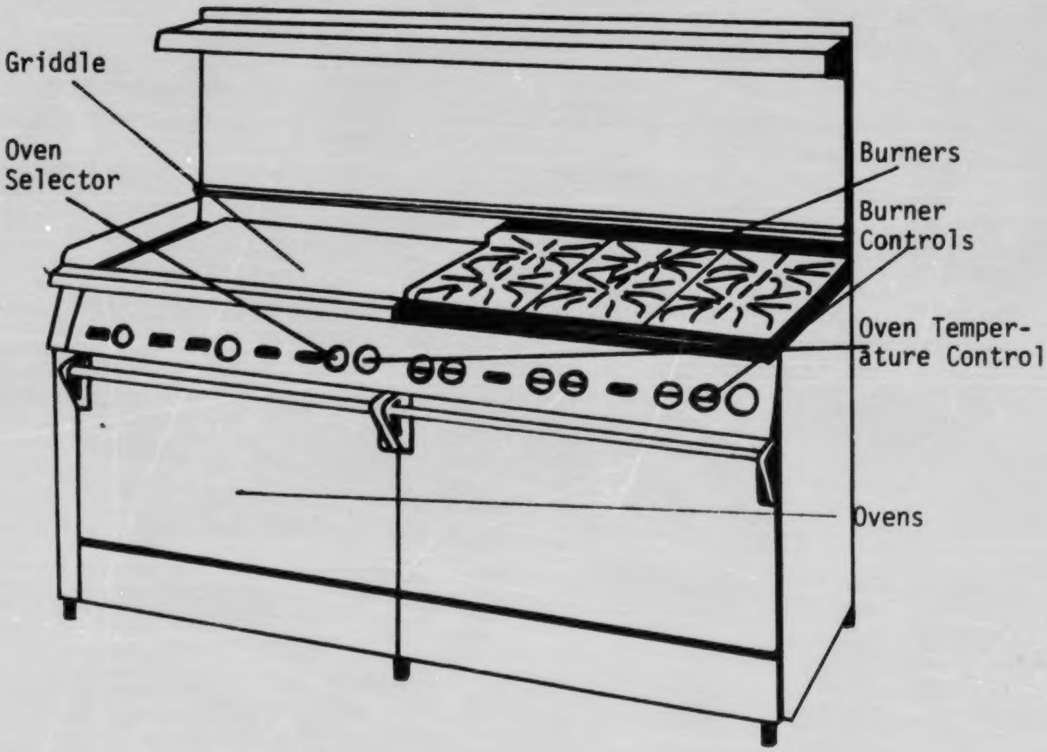
SAFETY PRECAUTIONS

1. Be sure range is properly installed and grounded.
2. Never use range for warming or heating a room.
3. Do not touch heating elements.
4. Never let clothing, pot holders or other flammable materials come into contact with the heating elements.
5. Do not leave children alone or unattended in area where range is in use.
6. Never wear loose fitting or hanging garments while using range.

7. Never use top or oven as a storage area.
8. Never use water on grease fire.
9. Always use dry pot holders when removing pans from oven or surface units.
10. Never leave surface units unattended at high heat setting.
11. Make sure reflector pans or drip bowls are in place and free of grease.
12. Do not use aluminum foil to line surface unit, drip bowls or oven bottom.
13. Use utensils on surface units that will not break.
14. Always turn utensil handles inward.
15. Do not soak or immerse heating elements in water.
16. Do not heat unopened food containers.
17. Keep oven vent ducts unobstructed.
18. Place oven racks in desired location while oven is cool.
19. Clean only parts listed in the owner's manual.

Major Appliances: Gas/Commercial Oven

DOUBLE OVEN


Griddle
Oven Selector
Burners
Burner Controls
Oven Temperature Control
Ovens

SAFETY PRECAUTIONS

1. Surface units and ovens should have a pilot light.
2. Do not turn on gas to light until you have a match lit.
3. Turn off pilot light when using oven cleaners.
4. Never use flammable liquids around gas oven.
5. Keep all air vents open.
6. Have gas company check immediately for any suspected leaks.
7. Keep pilot lights lit.

Major Appliances: Microwave Oven

OPERATION PROCEDURES

1. Close door and turn on master switch.
2. Open door and place food no more than 3 inches deep in oven on cooking dish.
3. Close door and set timer.
4. Cook according to recipe.

CLEAN UP PROCEDURES

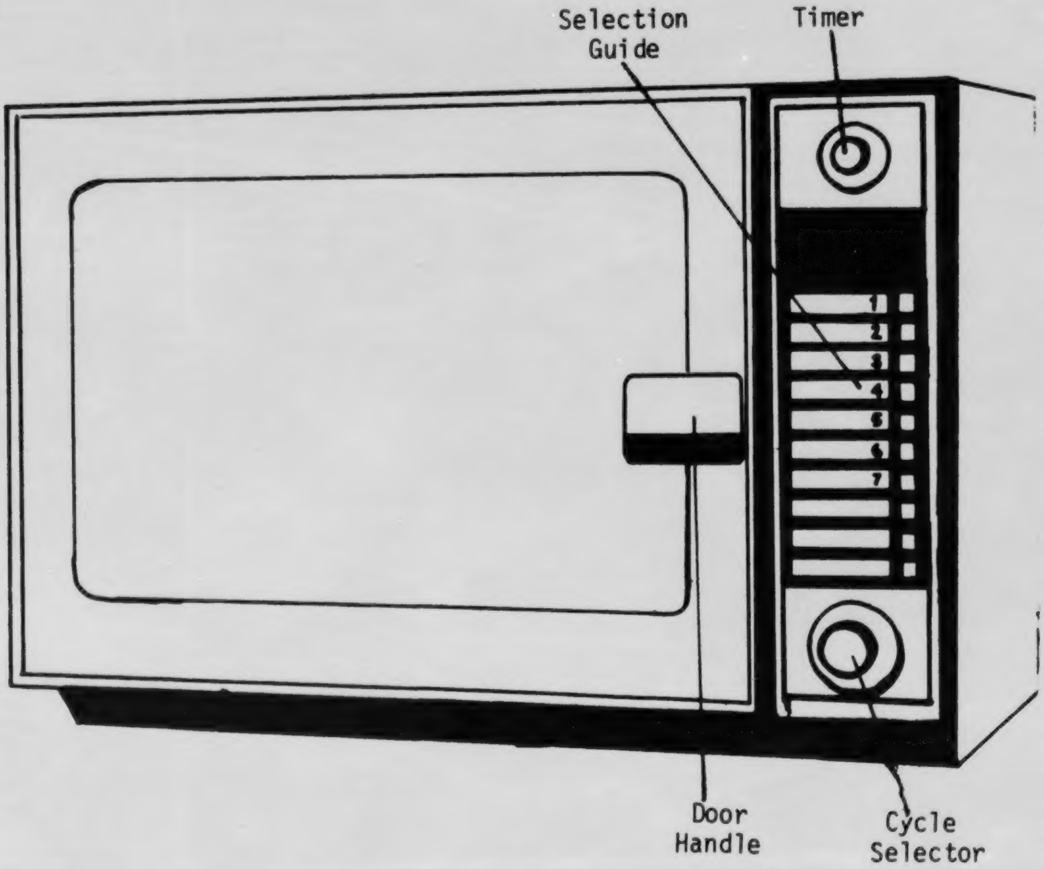
1. Turn off oven and let cool.
2. Remove trays and splatter shield and wash in mild detergent.
3. Wipe inside of oven with paper towels to remove liquid spills.
4. Wash with mild detergent.

STANDARD: All microwave ovens made after October 1971 are covered by a radiation safety standard.

1. Limits the amount of microwaves that can leak from an oven throughout its lifetime.
2. Requires ovens to be equipped with two independent interlock systems that stop the production of microwaves the moment the latch is released or door is opened.
3. Must have a label stating that they meet this safety standard.
4. Those produced after October 1975 must have a label explaining precautions for safe use.

TIPS ON SAFE OPERATIONS

1. Examine a new oven for evidence of shipping damage.
2. Never operate if the door does not close firmly or is bent, warped, or otherwise damaged.
3. Never insert objects through the door grill or around the door seal.
4. Never turn the oven on when empty.
5. Clean oven, door, and seals frequently.
6. Periodically check the seals.


Selection Guide
Timer
1
2
3
4
5
6
7
Door Handle
Cycle Selector

Major Appliances: Kitchen Ranges

It is estimated that more than 20,000 people receive hospital emergency room treatment each year for injuries involving gas and electric kitchen ranges. The elderly and very young are frequently involved.

The major accident patterns associated with ranges include:

1. Leaning over or against the range.
2. Reaching over or across the range.
3. Climbing on or around the range.
4. Flammable vapor fires.
5. Natural gas explosions.
6. Gas ranges which do not have pilot lights.
7. Pans of grease left unattended on a burner.
8. Hanging curtains or dishtowels around or over burners.

Following these suggestions for safety.

PURCHASING

- Knobs should be difficult for children to turn on.
- Controls should be located to eliminate reaching over burners.
- Electric ranges should have signal light to tell when range is on.
- Gas ranges should have pilot light for burners AND oven.

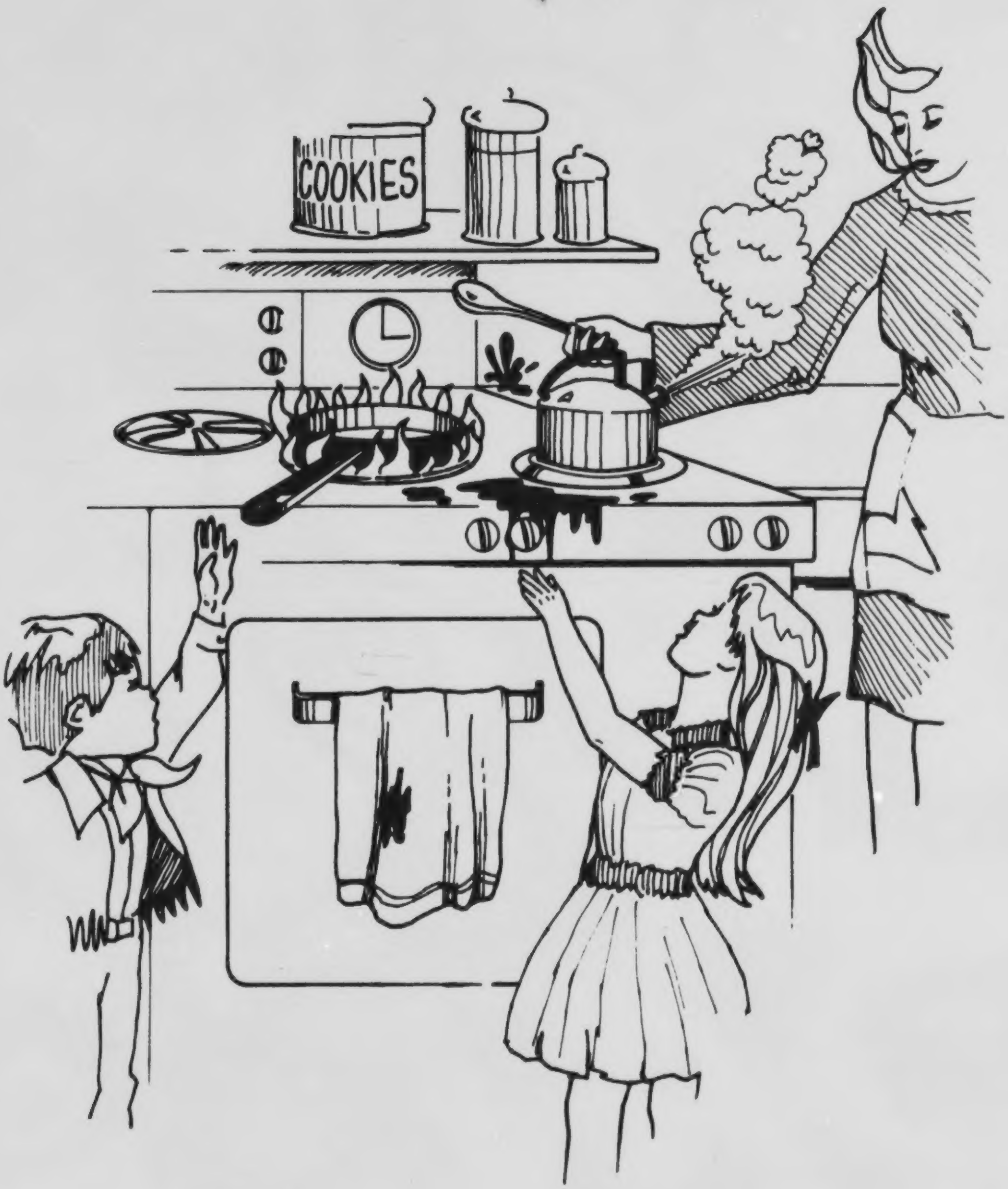
USING

- Wear tight-fitting clothing.
- Use pot holders, not towels or paper tissue.
- Keep children away.
- Keep curtains and dishtowels away.
- Don't turn back against range while it is on.

- Don't use oven or top for storage.
- Use proper size burner for pot size.
- Learn how to light a gas range properly.
- In gas ovens, turn off pilot light when you use an oven cleaner.
- Keep air vents open.
- Don't use range to heat the room.
- Use proper utensils.
- Know what to do with grease fires.

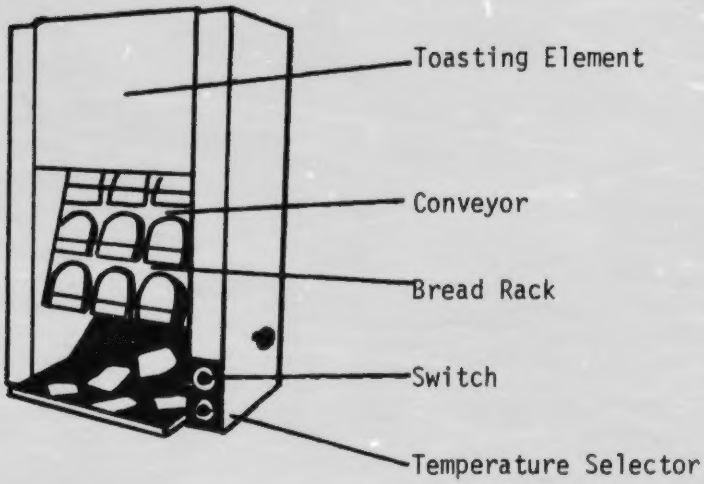
MAINTAINING

- Always check to make certain range has been turned off when you're finished using it.
- Check kitchen occasionally to look for possible hazards.
- Clean up grease deposits around burners and in oven.



BE AWARE THAT ONE OF THE MOST IMPORTANT APPLIANCES IN YOUR HOME CAN ALSO BE ONE OF THE MOST HAZARDOUS.

Major Appliances: Rotary Toaster


Toasting Element
Conveyor
Bread Rack
Switch
Temperature Selector

OPERATION PROCEDURES

1. Set thermostat to 5.
2. Open gas valve and insert lighted match into lighter holes.
3. Inspect flames.
4. Preheat toaster 10-15 minutes.
5. Start motor for baskets to rotate.
6. Run two slices of bread through and make temperature adjustment if necessary.
7. Run bread through, butter and stack.

CLEAN UP PROCEDURES

1. Turn off machine.
2. Brush crumbs from front of toaster.
3. Remove slanted toast guide and tray below toaster.

4. Brush dry crumbs from guide, tray and surrounding areas.
5. Wash toaster frame and the area under toaster.
6. Wash guide, tray, and surrounding areas.
7. Replace toast guide and tray.

SAFETY PRECAUTIONS

1. Front and back flames should be the same size and as large as possible without yellow tips.
2. Do not stick any utensil into unit.
3. Use tongs to pick up toast.
4. Clean crumb tray regularly.
5. Unplug when not in use.

Major Appliances: Steam Cooker

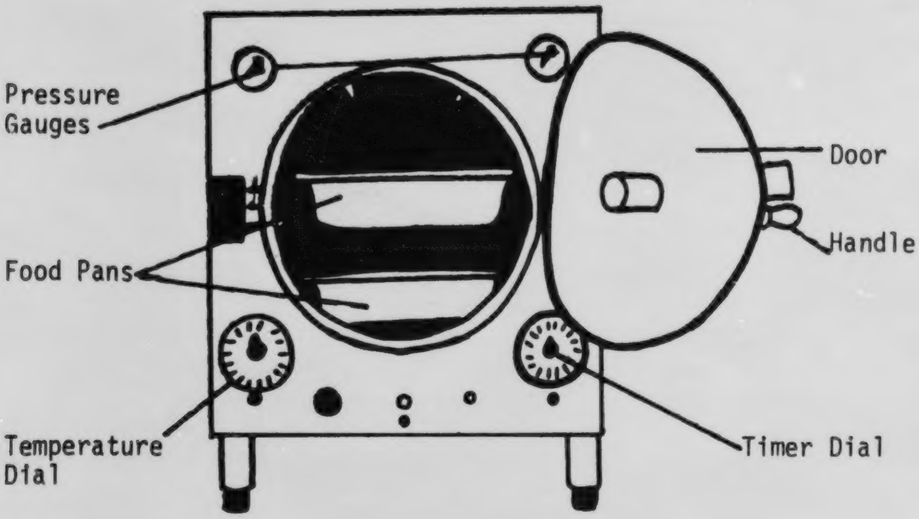
OPERATION PROCEDURES

1. Place food in proper size pan.
2. Place pan on the pull out shelf.
3. Close and lock door.
4. Turn on steam.
5. Set timer.
6. Reverse closing procedure.
7. Remove food.

CLEAN UP PROCEDURES

1. Turn off steam and allow to cool.
2. Remove shelves and wash.
3. Scrub and rinse chambers.
4. Close steamer.
5. Turn on for one minute.
6. Turn off steamer and open.
7. Allow to air dry.
8. Replace shelves.
9. Wipe off outside and top.
10. Leave doors ajar.

STEAM COOKER


Pressure Gauges
Door
Handle
Food Pans
Temperature Dial
Timer Dial

SAFETY PRECAUTIONS

1. On wheel operation, if steam leaks appear, tighten wheel slightly.

2. After loosening wheel when cooking is complete, let steam escape before opening the door, and use hot pads.

3. Allow pressure to go to 0^{0} before opening.

4. Do not wrench door wheel tight.

Major Appliances: Steam Jacketed Kettle

A steam jacketed kettle is described as two stainless steel hemispheres, or bowls, one sealed inside the other with about two inches of space in between for the steam.

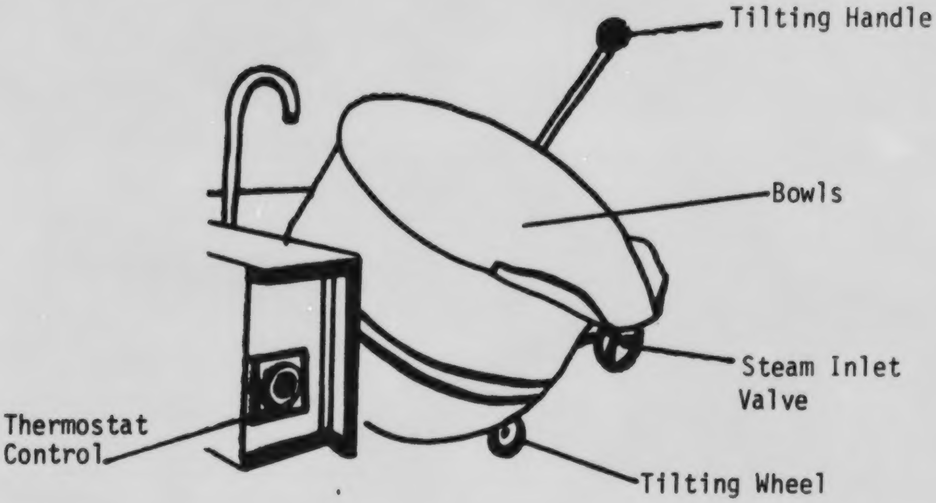
OPERATION PROCEDURES

1. Adjust kettle to upright level position.
2. Fill kettle with food or water food will be cooked in.
3. Turn on steam control valve.
4. Complete cooking.
5. Close steam control valve.
6. Remove food to prevent overcooking.

CLEAN UP PROCEDURES

1. Turn off steam and allow kettle to cool.
2. Open drain and flush kettle.
3. Close drain and remove drain screen.
4. Fill kettle to cover highest food line with water, add detergent.
5. Scrub kettle inside and outside.
6. Drain solution.
7. Rinse kettle and close drain.
8. Allow inside of kettle to air dry and then wipe out.
9. Close cover.

STEAM JACKETED KETTLE


Tilting Handle
Bowls
Steam Inlet Valve
Thermostat Control
Tilting Wheel

SAFETY PRECAUTIONS

1. Food or water should not exceed 3/4 of the capacity of the kettle.
2. Make sure only trained personnel operate.
3. Turn steam off before draining what is cooking.

SAFETY QUIZ

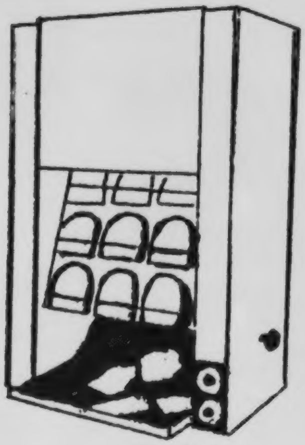
FOOD COOKING EQUIPMENT

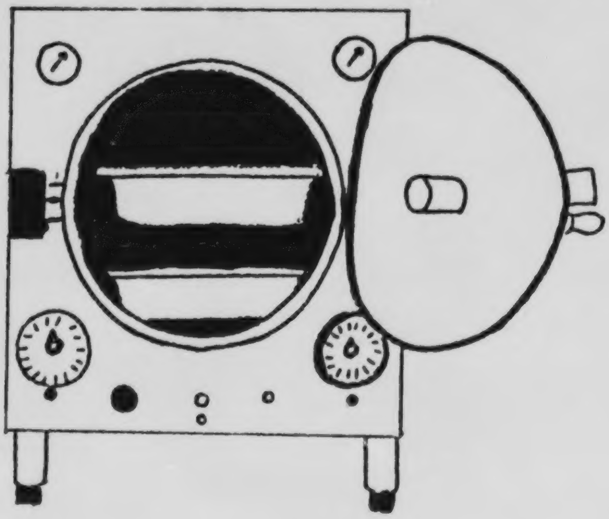
Name ______________________

Date ______________________

Identify each of the following appliances by placing the correct name in the space provided.

1. ______________________ 2. ______________________

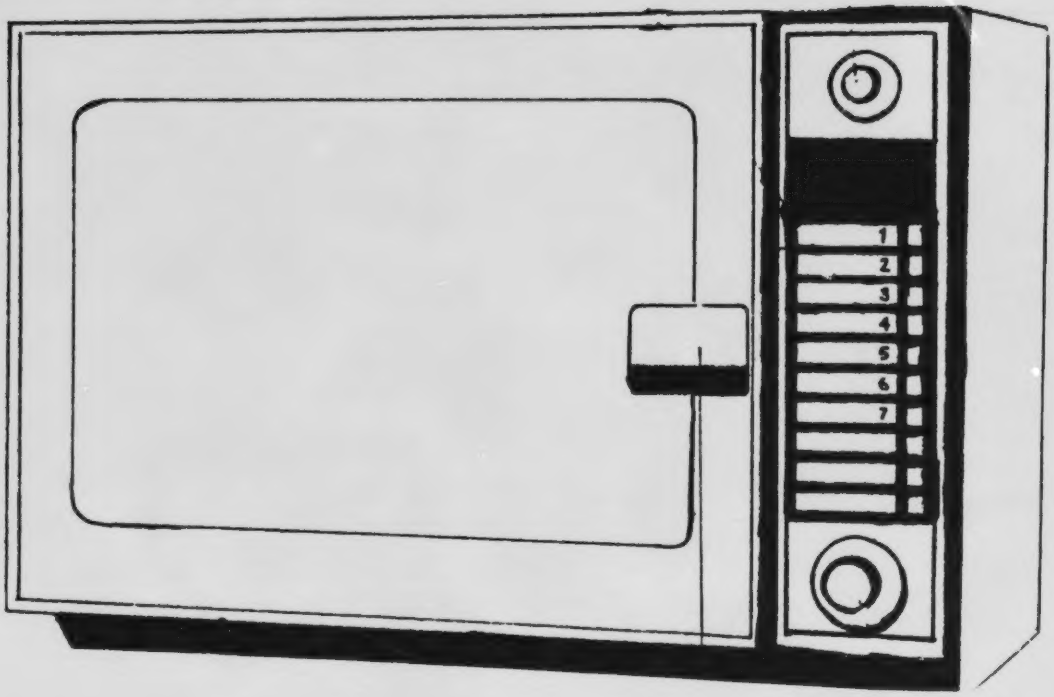




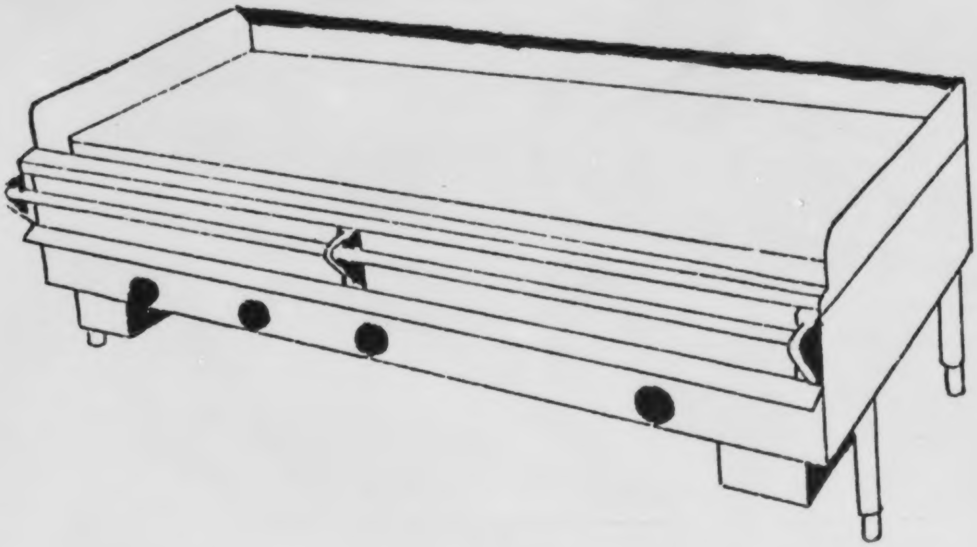
61

Safety Quiz: Food Cooking Equipment continued

3. ______________________________

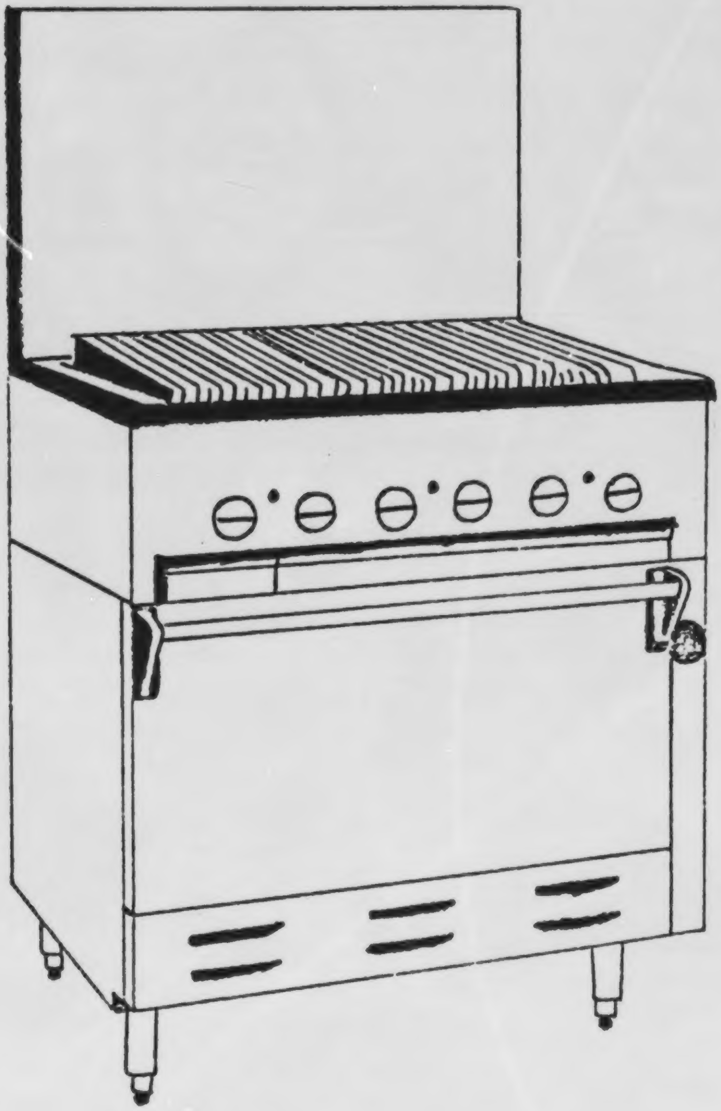


4. ______________________________



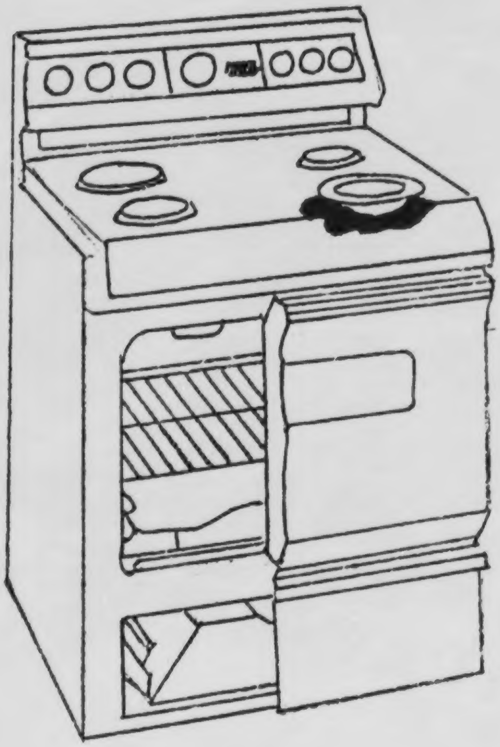
Safety Quiz: Food Cooking Equipment continued

5. ______________________________



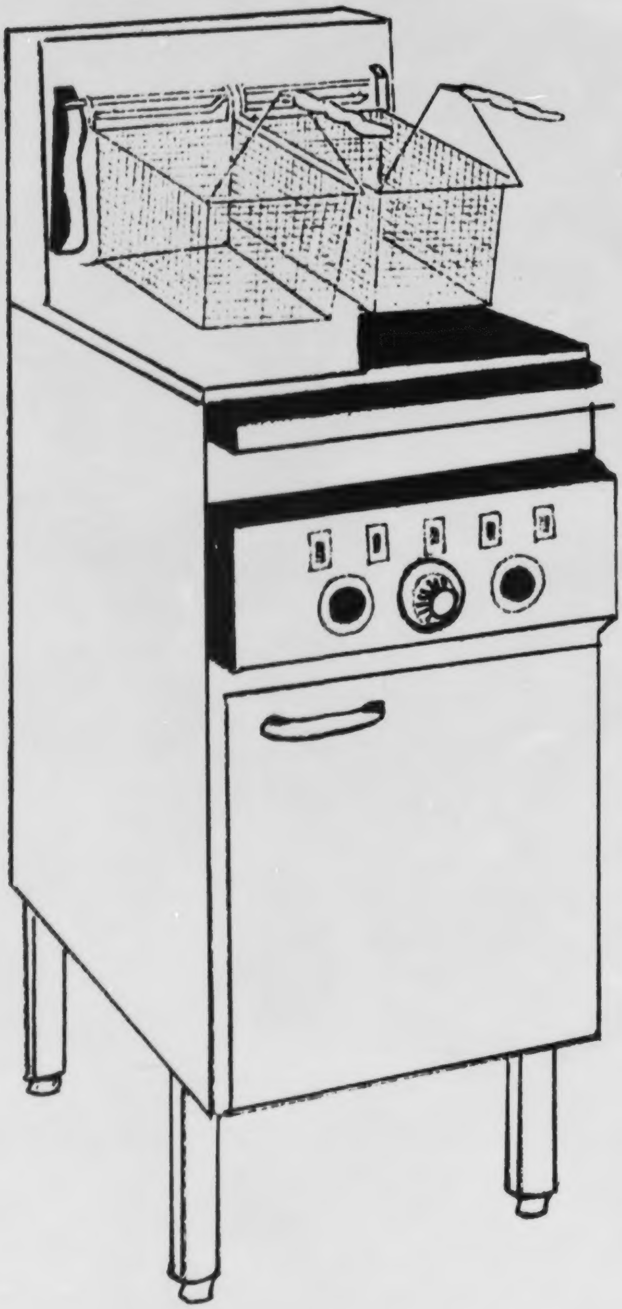
Safety Quiz: Food Cooking Equipment continued

6. ______________________________



Safety Quiz: Food Cooking Equipment continued

7. ____________________



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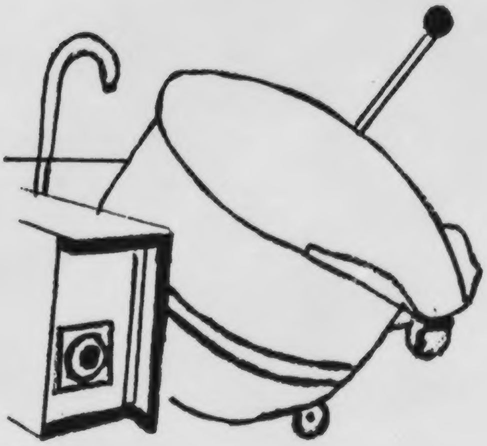
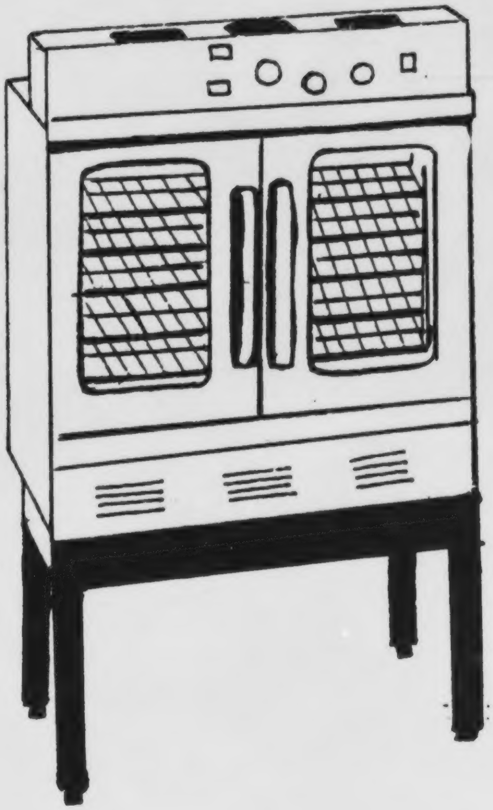
Safety Quiz: Food Cooking Equipment continued

8. ____________________

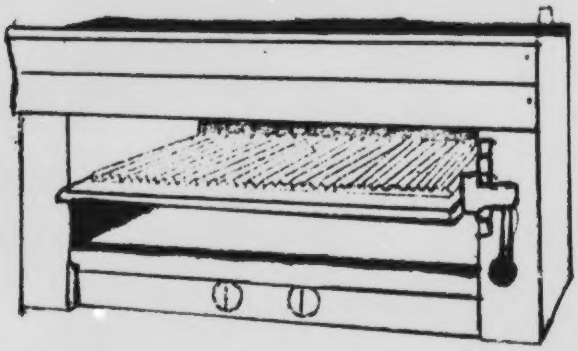


9. ____________________

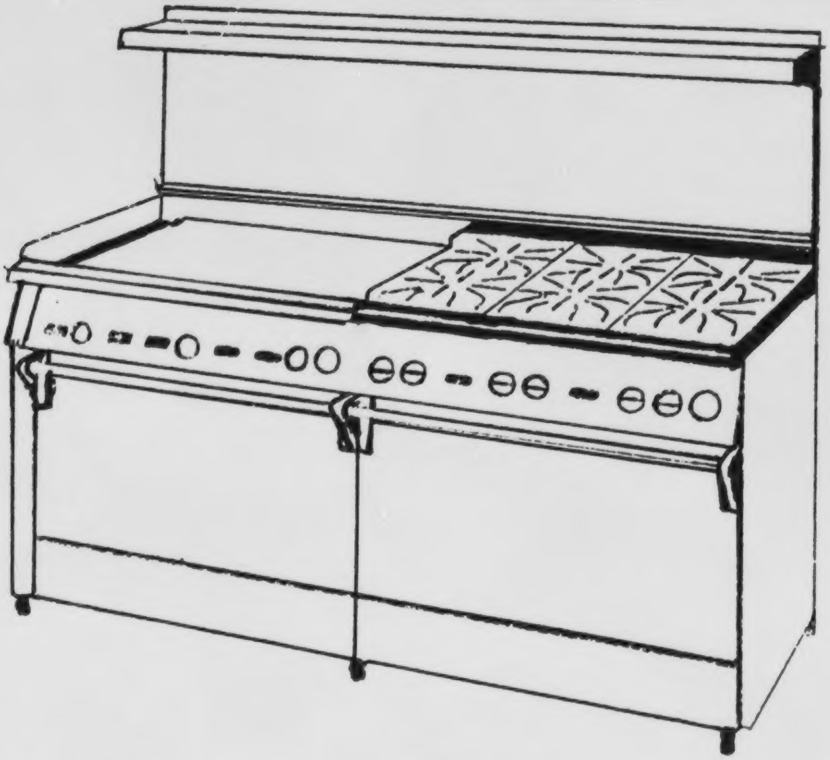


Safety Quiz: Food Cooking Equipment continued

10. ____________________



11. ____________________



Safety Quiz: Food Cooking Equipment continued

TRUE or FALSE

1. Keeping the grill clean can prevent flash fires. ____________

2. Regardless of how much cooking is done on a grill it is satisfactory to empty the grease trays only when cleaning up at the end of the day. __________

3. Always use a grill, broiler, etc., under a vented hood. _______

4. When operating a rotary toaster, clean the crumb tray often. __________

5. Never remove items from a deep fat fryer to an area behind you. ____________

6. Always double check the deep fat fryer before leaving the establishment to make sure it has been turned off. ____________

7. Test the grill for desired temperature by touching or by dropping water onto it. ____________

8. Never leave food that is frying on a grill, in a deep fat fryer, or on a char broiler to attend to another task. ____________

9. Do not turn on a microwave oven when it is empty. ____________

10. Never use a range to heat a room. ___________

11. Always double check to make sure surface units and ovens have been turned off after using. ____________

SHORT ANSWER

1. Which ovens are sometimes referred to as air-flow ovens?

   ____

2. When purchasing gas ranges make sure that both the surface units and the oven have _________________________ lights.

3. Fat in a deep fat fryer should never be heated to over _____ °F.

FOOD PREPARATION EQUIPMENT

Food Cutter or Chopper

This is another versatile piece of equipment. It has many attachments and can do jobs such as chopping, grinding, slicing, dicing, and shredding. It has a revovling knife that will chop foods quickly and efficiently.

OPERATION PROCEDURES

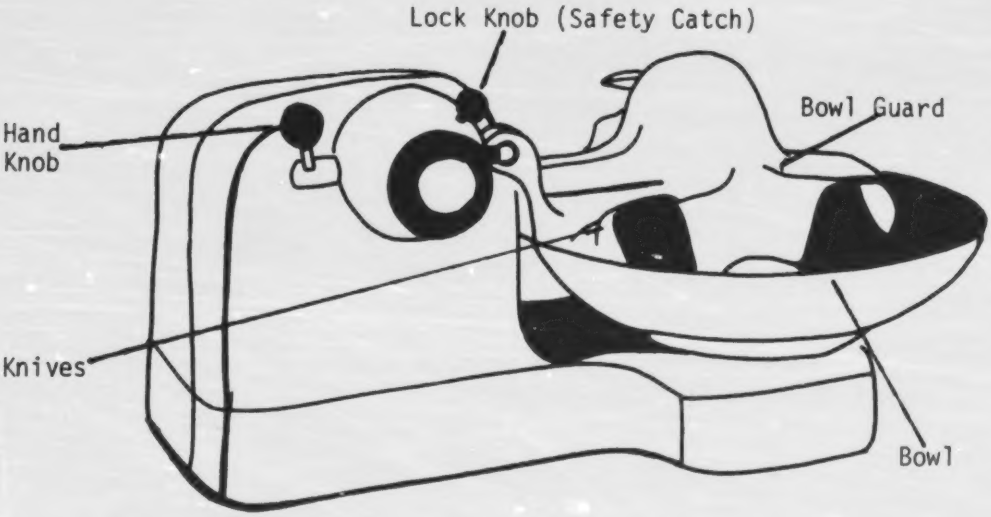
1. Turn switch off and unplug machine.
2. Place bowl in position and rotate counterclockwise to stop.
3. Place knife on knife shaft.
4. Screw hand knob into position to hold knives securely.
5. Place comb in position.
6. Place lid in closed-locked position.
7. Plug in machine.
8. Fill bowl 1/3 full and turn on switch.
9. Stop machine; switch to off and do not lift cover until knives have stopped moving.
10. Open cover.
11. Turn lock knob to right angle.
12. Unscrew hand knob and slide off knife assembly.
13. Remove food from bowl.

CLEAN UP PROCEDURES

1. Turn off switch and unplug machine.
2. Wait for blades to stop.
3. Turn cover lock and pull up.
4. Raise cover to upright position.
5. Remove blade guide and blade and place both in bowl.
6. Lift cover.

7. Remove bowl.
8. Scrub and rinse shell.
9. Wash and rinse parts.
10. Allow to air dry.
11. Reassemble.

FOOD CUTTER


Lock Knob (Safety Catch)
Hand Knob
Bowl Guard
Knives
Bowl

SAFETY PRECAUTIONS

1. Never put hands in bowl when in use.
2. Use large spoon to guide food into the cutters-NEVER hands.
3. Wait until bowl comes to complete stop before removing food or cleaning.
4. Fill bowl only 2/3 full, do not overload.
5. After cleaning, reassemble immediately.

Major Appliances: All Purpose Mixer (20 quart)

One of the most versatile pieces of equipment in a commercial kitchen. With its numerous attachments it is designed to do many different jobs. It will whip, grind, shred, slice and chop foods. Usually these large mixers are bolted to the floor or counter top depending upon which model is used. They are considered hazardous because it is easy to sever fingers or be pulled into one when wearing loose clothing.

Bakery Equipment, Mixers, OSHA Standards.

1. Mixers with external power application shall have all belts, chains, gears, pulleys, sprockets, clutches, and other moving parts completely enclosed.

2. Mixers with built-in power units shall have all drive elements enclosed in such a manner as to prevent injury to operators or maintenance personnel performing their normal duties.

3. Each mixer shall be equipped with an individual motor and control, and with a conveniently located manual switch to prevent the mixer from being started in the usual manner while the machine is being serviced and cleaned.

4. All electrical control stations shall be so located that the operator must be in full view of the bowl in its open position. No duplication of such controls other than a stop switch shall be permitted.

5. All mixers with power and manual dumping arrangements shall be equipped with safety devices which shall:

    a. Engage both hands of the operator, when the agitator is in motion under power, and while the bowl is opened more than one-fifth of its total opening.

    b. Prevent the agitator from being started, while the bowl is more than one-fifth open, without engaging both hands of the operator.

    c. Permit the operator to have a full view of the bowl opening while he is in the act of maintaining operation of the agitator at any time while the bowl is more than one-fifth open.

6. Mixers with power dumping devices shall be arranged so that the bowl opening cannot be closed beyond four-fifths of its total opening unless the operator maintains the control contact which causes the dump motor to complete the bowl closure. Alternatively the control may be so arranged that the operator must keep at least one hand engaged, by holding in a push button, during the entire closure of the mixing bowl.

7. Mixers shall be provided with flour-gate operating mechanisms, ingredient openings, and water inlets, which can be conveniently manipulated by the operator from the normal area of activity (either platform or floor) without requiring abnormal reaching, or improvisations which might jeopardize his safety.

8. Every mixer shall be equipped with a full enclosure over the bowl which is closed at all times while the agitator is in motion. Only minor openings in this enclosure, such as ingredient doors, flour inlets, etc., each representing less than 1½ square feet in area, shall be capable of being opened while the mixer is in operation.

9. No loose access doors and covers weighing more than 2 pounds shall be used on mixers. Such parts shall be hinged or otherwise held in proximity to the openings that they cover.

10. Overhead covers or doors which are subject to accidental closure shall be counterbalanced to remain in an open position or provided with means to hold them open until positively released by the operator.

11. Provision shall be made to bolt mixers solidly to the floor to prevent dislocation or excessive vibration, and no open space between mixers and platforms shall be permitted which may endanger the operator.

12. Mixers shall be installed only on substantial foundations which are capable of safely withstanding the live loads incurred in full-capacity mixing operations.

13. Access for lubrication at all points shall be provided so as to avoid contact between the lubricating device or the operator's hands and any moving parts.

14. No electrical pilot or control circuits shall be employed at a potential in excess of 240 volts.

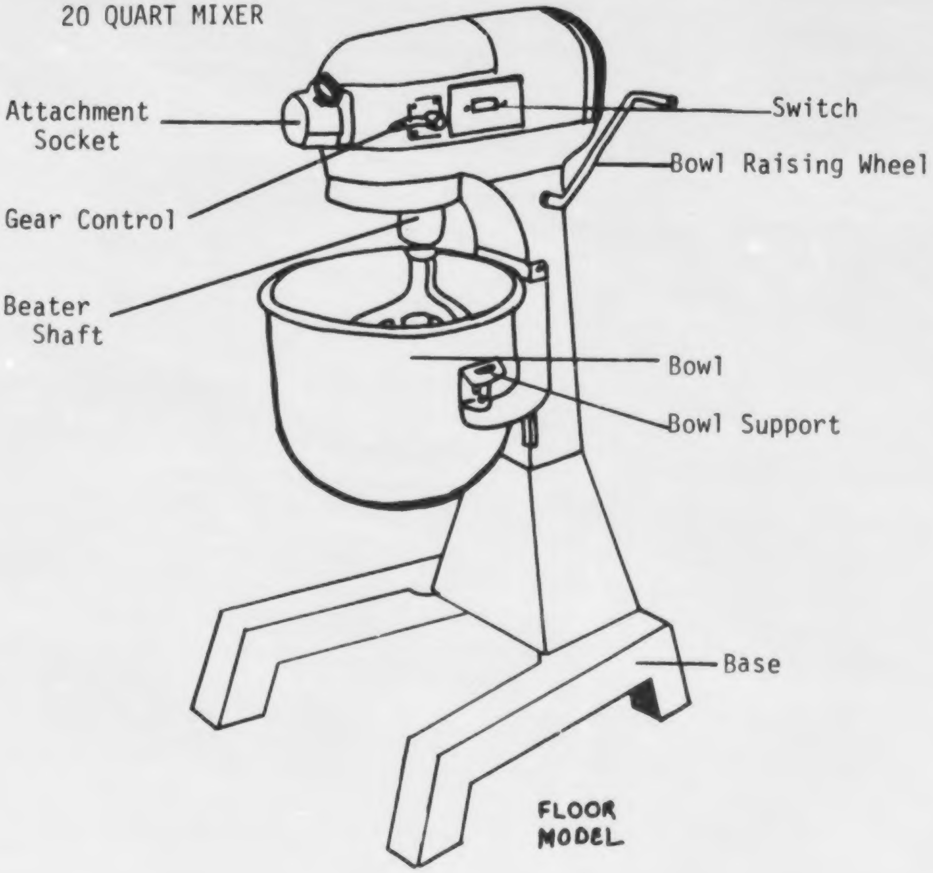
15. A motor-running overcurrent protective device shall be provided for each motor. Undervoltage protection shall be provided in all magnetic controllers.

16. Positive means shall be provided to prevent application of pressure above the stipulated maximum in all mixer cooling jackets.

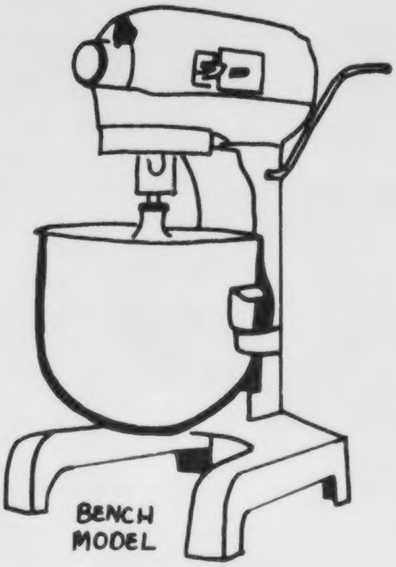
Vertical Mixers.

1. Positive means shall be provided to prevent injury to the operator during speed-change manipulation.
2. Bowl locking devices shall be of a positive type which require the attention of the operator for unlocking.
3. Devices shall be made available for moving bowls weighing more than 80 pounds, with contents, into and out of the mixing position on the machine.
4. Every precaution which does not impair the normal operation of the mixer shall be exercised in providing protection of the operator against injury by the moving agitators.

20 QUART MIXER


Attachment Socket
Switch
Bowl Raising Wheel
Gear Control
Beater Shaft
Bowl
Bowl Support
Base
FLOOR MODEL

SAFETY PRECAUTIONS



1. Remove attachments such as beaters, dough hooks, etc., before washing.
2. When attaching beaters, make sure the control is switched to OFF and the appliance is unplugged.
3. Clothing should have no loose strings, ties, or loose material.
4. Install bowl properly to prevent spillage.
5. Install beaters properly to prevent them from coming apart during operation.
6. Make sure utensils or other objects do not fall into the batter.
7. Do not overload the bowl.
8. Do not wipe the inside of the bowl while beaters are rotating.
9. Turn motor off before changing gears.
10. Wear no dangling jewelry or other accessories.
11. Use slow speed with dry ingredients.

Major Appliances: Slicer

This machine which is used primarily to cut meats, can accidently sever fingers or cause deep cuts. It must be treated with great care and considered hazardous.

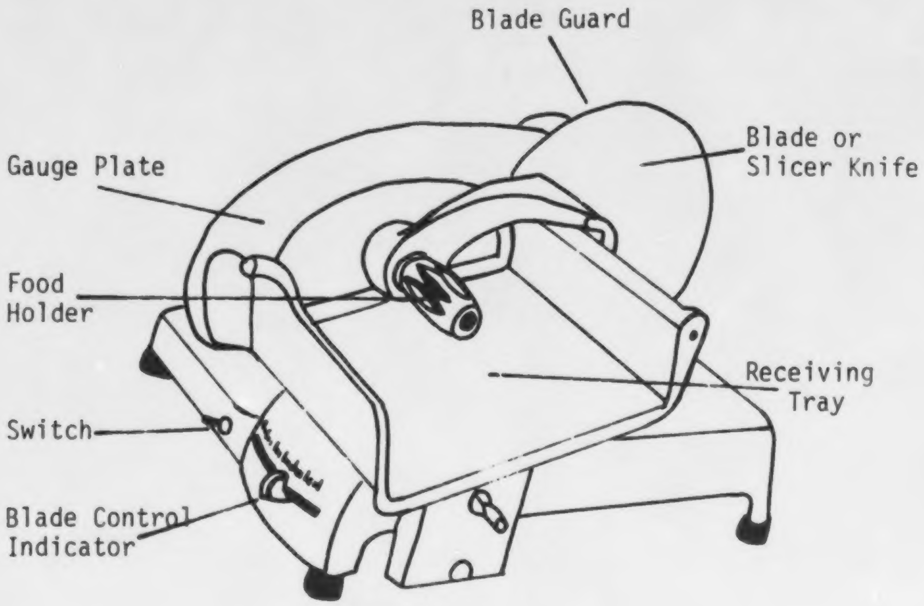
OPERATION PROCEDURES

1. Place chute on slide carriage.
2. Screw bolts till tight.
3. Place center plate in position.
4. Place large knife guard in position.
5. Place food on chute and cover with holder.
6. Move arm to check free movement.
7. Adjust indicator to desired number.
8. Turn machine ON and slice 2-3 slices.
9. Turn machine OFF and examine food for proper size and accurate weight.
10. Readjust if necessary and slice the number of portions desired.

CLEAN UP PROCEDURES

1. Turn off machine and unplug.
2. Set blade control to zero.
3. Turn knob to remove meat carriage.
4. Loosen knob at center of blade to remove top blade guard.
5. Scrub and rinse parts.
6. Wash blade and machine shell.
7. Sanitize blade, and allow to air dry.
8. Replace front blade guard immediately after cleaning shell.
9. Replace and tighten blade guard and meat carriage.
10. Set blade control to zero.

SLICER


Blade Guard
Blade or Slicer Knife
Gauge Plate
Food Holder
Receiving Tray
Switch
Blade Control Indicator

SAFETY PRECAUTIONS

1. Never use when knife guard is not in position.
2. Always keep hands and utensils away from blade when operating.
3. Always unplug when not in use.
4. Always check knife guard before plugging in.
5. When cleaning, never leave blade exposed longer than necessary.
6. The slicer should be located out of the traffic flow.
7. It must be bolted and electrically grounded.
8. When cleaning the blade never touch the cutting edge with hands.
9. The guards should ALWAYS be over blade.

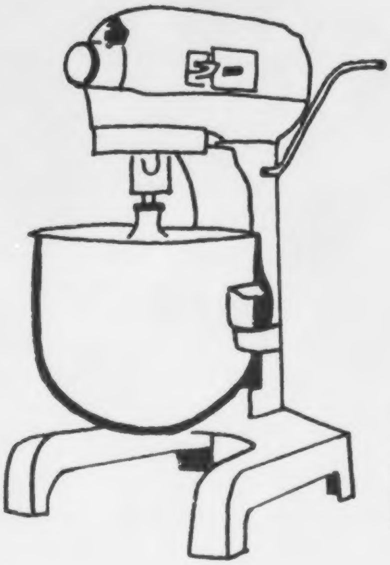
SAFETY QUIZ

FOOD PREPARATION EQUIPMENT

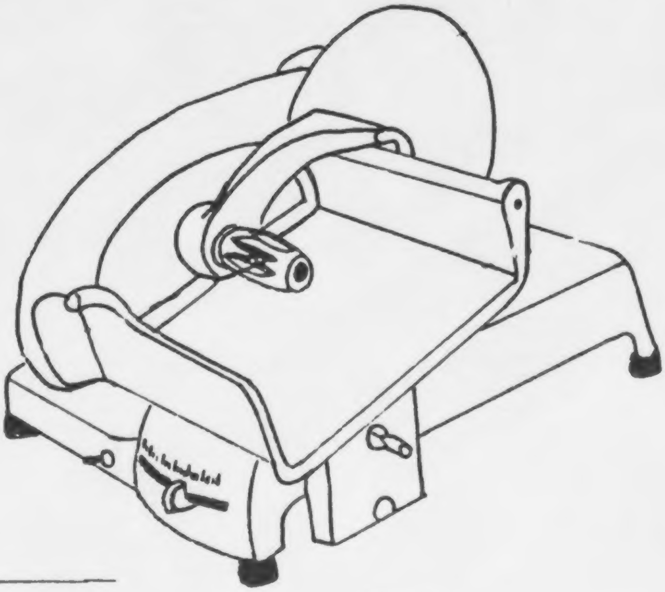
Name ______________________________
Date ______________________________

Identify each of the following appliances by placing the correct name in the space provided.

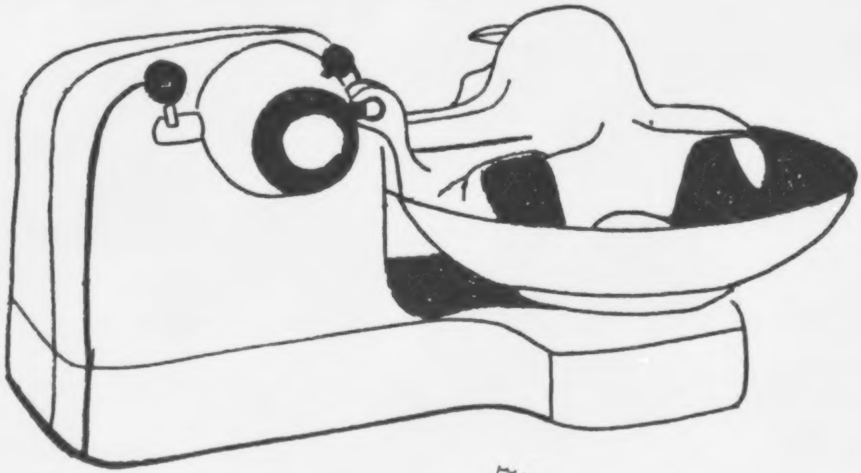
1. ____________________________



2. ______________________________



3. ___________________________



Safety Quiz: Food Preparation Equipment continued

SHORT ANSWER

1. Which of the shown appliances are considered hazardous? Why?____

   ____

   ____

TRUE or FALSE

2. When operating a large mixer, it is okay to wear long bell-shaped sleeves. ______________

3. Always turn the motor off and unplug the machine before changing gears or attachments such as blades, beaters, etc.

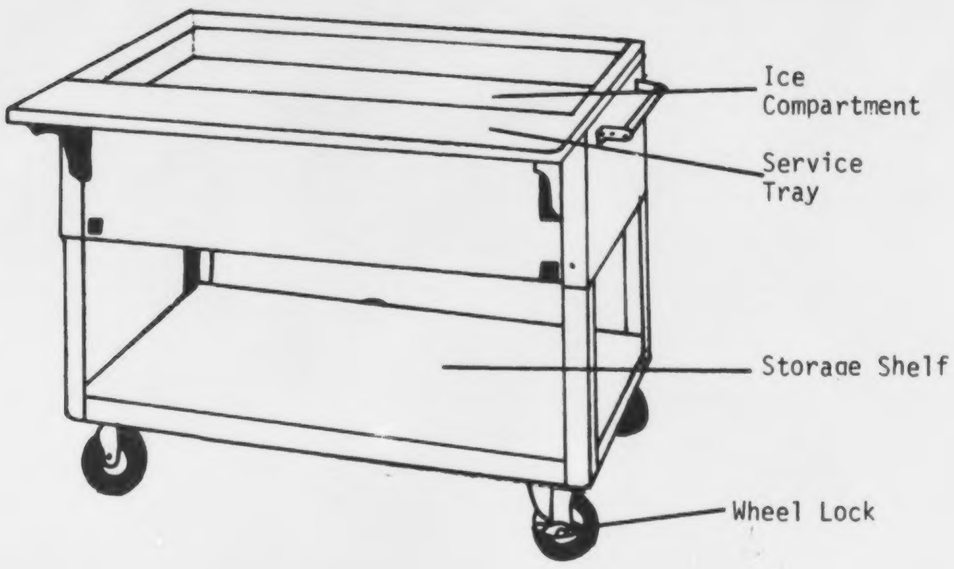
   ____

4. When operating a slicer it is acceptable to do so if the knife guard is not in position. ______________

5. A slicer should be located out of traffic flow pattern in a kitchen. ______________

FOOD STORAGE AND HANDLING EQUIPMENT

COLD PAN UNIT


Ice Compartment
Service Tray
Storage Shelf
Wheel Lock

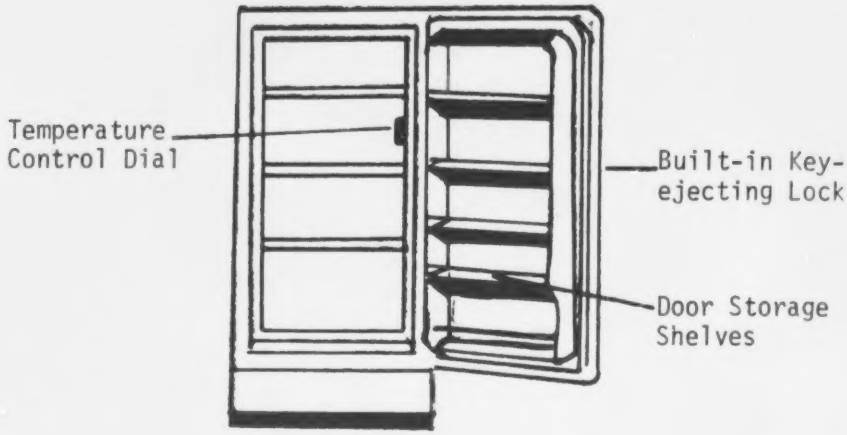
SAFETY PRECAUTIONS

1. Check drain plug before putting in the ice.
2. After positioning, make sure wheels are locked to prevent movement.
3. After filling ice compartment, make sure any spilled ice has been cleaned to lessen slips and falls.

SAFETY PRECAUTIONS

1. Remove doors or impede closing of doors of freezers that are being discarded or stored to eliminate child entrapment.
2. Always plug it into its own individual electrical outlet.
3. Do not operate in the presence of explosive fumes.
4. Always remove power cord from wall outlet before removing base grille.
5. Don't refreeze frozen foods which have been thawed completely.
6. Do not use any electrical device or sharp instrument in defrosting.
7. If extension cords must be used-it is absolutely essential that a UL listed 3-wire grounding-type appliance extension cord be used.

FREEZER


Temperature Control Dial
Built-in Key-ejecting Lock
Door Storage Shelves

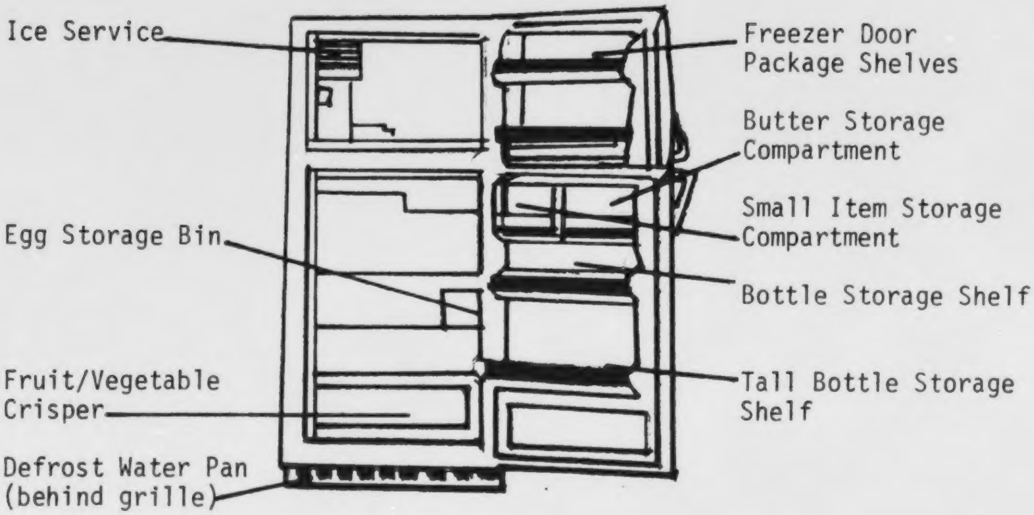
Home Model Refrigerator

SAFETY PRECAUTIONS

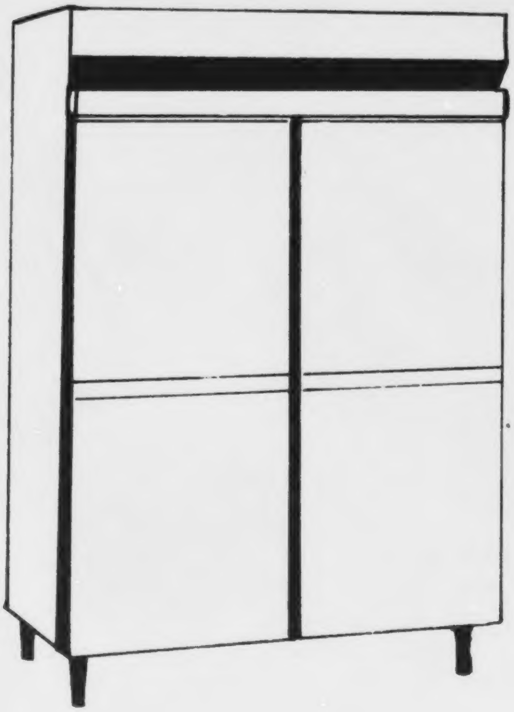
1. Remove doors of refrigerators to discard or store.
2. Always plug it into its own electrical outlet.
3. Do not operate in presence of explosive fumes.
4. Unplug when replacing a light bulb.
5. Always remove power cord from wall outlet before removing base grille.
6. Do not place fingers or hands on automatic icemaking mechanism while refrigerator is plugged in.

Major Appliances: Refrigerator

HOME MODEL


Ice Service
Freezer Door Package Shelves
Butter Storage Compartment
Small Item Storage Compartment
Egg Storage Bin
Bottle Storage Shelf
Fruit/Vegetable Crisper
Tall Bottle Storage Shelf
Defrost Water Pan (behind grille)

COMMERICAL MODEL



Major Appliances: Steam Table

OPERATION PROCEDURES

1. Close drain.
2. Add water to desired level.
3. Turn on heating element.
4. Reduce heat when boiling begins.

FOR DRY HEAT (ELECTRIC)

1. Turn on heating element.
2. DO NOT add water.

CLEAN UP PROCEDURE

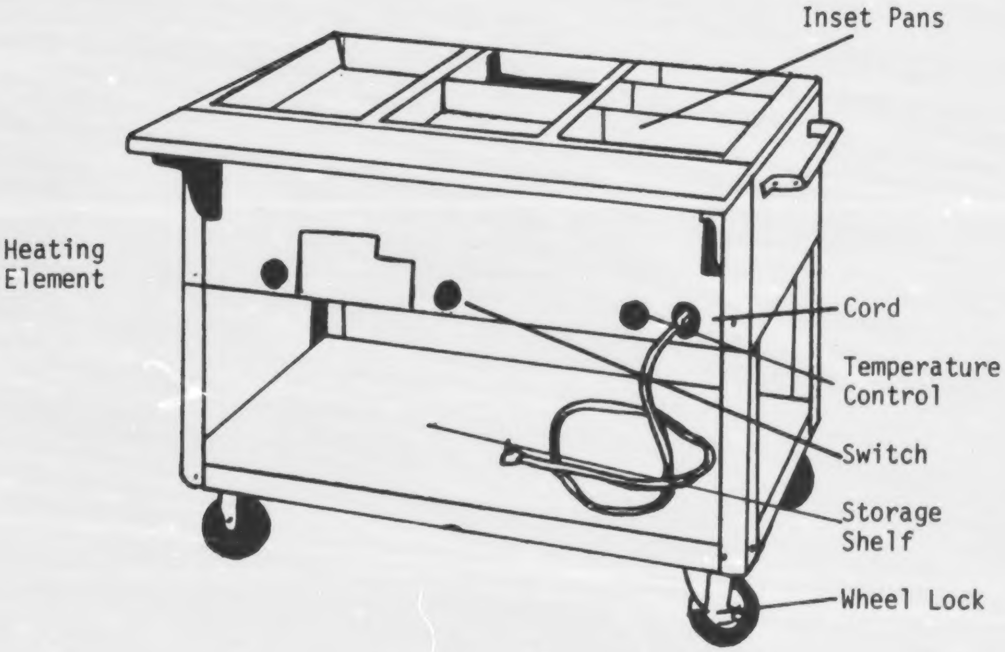
FOR MOIST WELLS

1. Turn off steam and drain.
2. Wash front and back of table.
3. Wash top of table and wipe dry.

FOR DRY HEAT (ELECTRIC)

1. Turn off and allow to cool.
2. Scrub exterior of well.
3. Wash cabinet and container.
4. Wash lids to wells.
5. Replace container and lids.

STEAM TABLE


Inset Pans
Heating Element
Cord
Temperature Control
Switch
Storage Shelf
Wheel Lock

SAFETY PROCEDURES

1. In areas with hard water, steam tables should be delimed weekly.
2. In electric tables, water must never come in contact with the heating elements.
3. Allow water to cool before emptying.
4. Use hot pads when transferring inset pans.
5. Unplug unit with dry hands.
6. Lift inset pans away from body to avoid steam.
7. Plug unit into outlet that is out of traffic pattern.

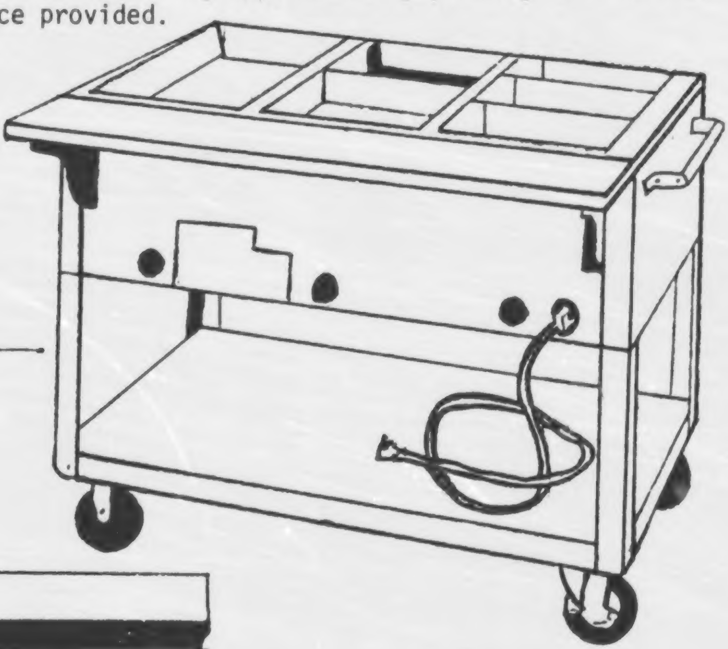
SAFETY QUIZ

FOOD STORAGE/HOLDING

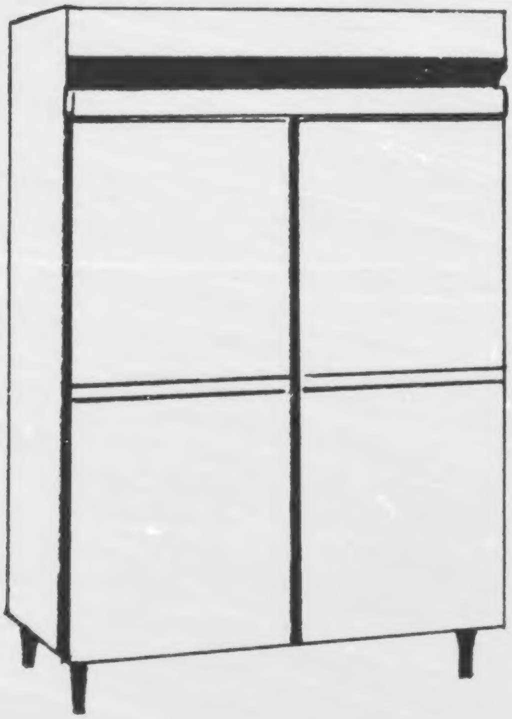
Name ______________________________

Date ______________________________

Identify each of the following appliances by placing the correct name in the space provided.



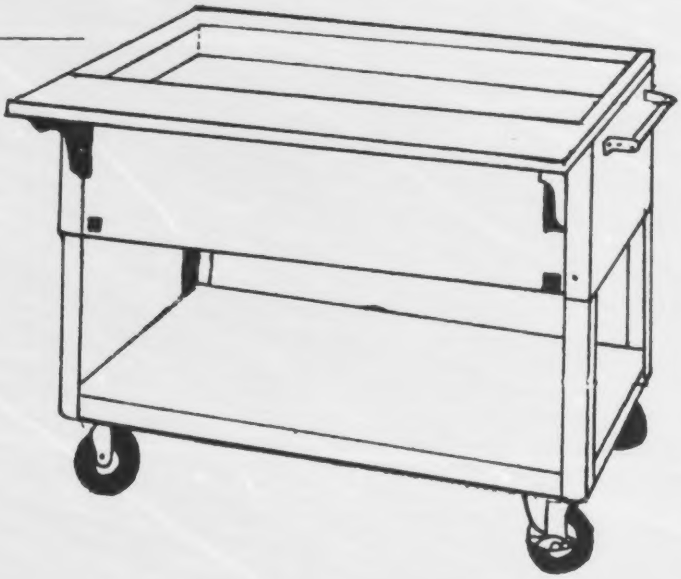
1. ______________________________



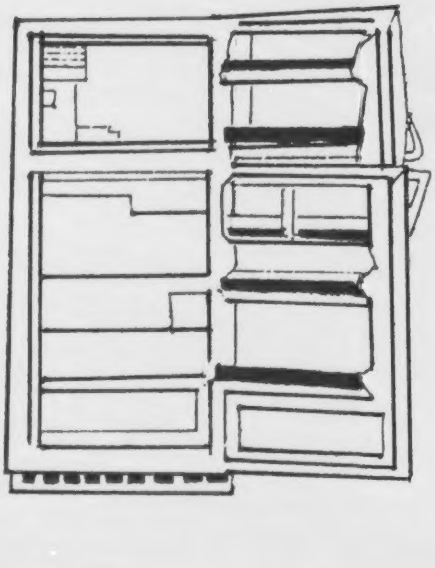
2. ______________________________

Safety Quiz: Food Storage/Holding continued

3. ________________________________



4. ________________________________



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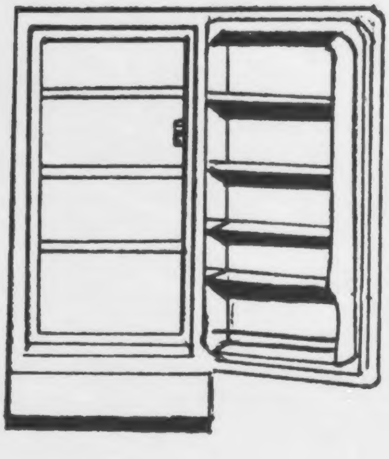


HOUSEHOLD EQUIPMENT/FURNITURE

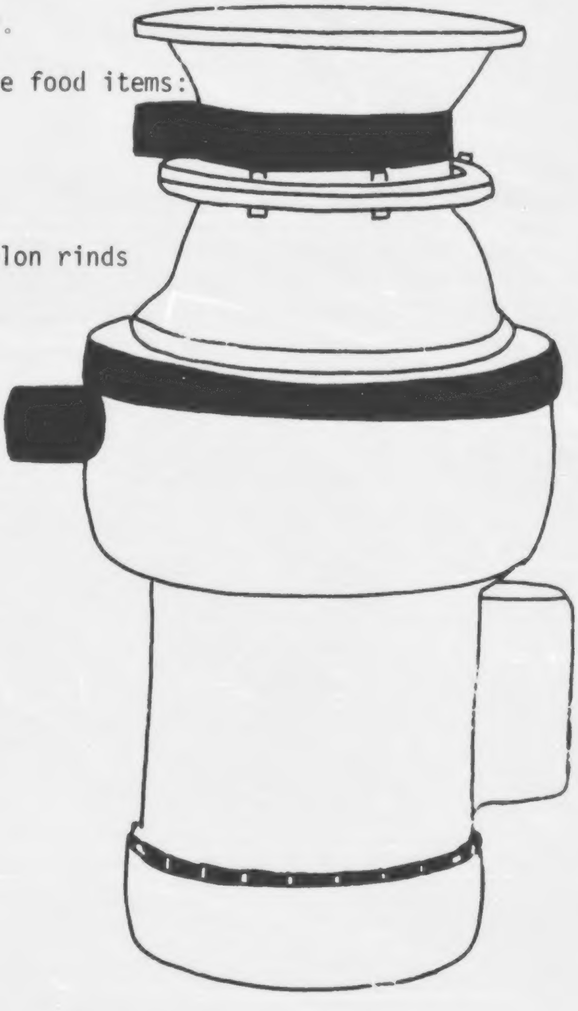
GARBAGE/WASTE DISPOSAL

OPERATION PROCEDURES: PRESS ON SWITCH.

1, Water will come on automatically.
2. Feed garbage gradually.
3. Do not feed ungrindable food items:

   Bones
   Cobs
   Cores
   Paper
   Cantaloupe/watermelon rinds
   Grapefruit peels

4. Keep fingers and and hands away.
5. Run five minutes after grinding stops.
6. Clean unit by turning to OFF and washing with mild detergent.



Major Appliances: Smoke Detectors

A smoke detector in your home should provide an early warning when a fire begins and enable you to escape safely. Most fire victims die from the inhalation of smoke and toxic gases rather than flame. In addition to saving lives, smoke detectors can help reduce property loss because fires can be detected and extinguished early.

There are two types of smoke detectors on the market.

1. ION CHAMBER DETECTORS - detect both visible and invisible products of combustion. This uses a radioactive source to produce electrically charged molecules (ions) in the air.

2. PHOTOELECTRIC DETECTORS - detect only visible products of combustion. This uses a light source and a light sensitive cell inside a darkened chamber.

SUGGESTIONS ON

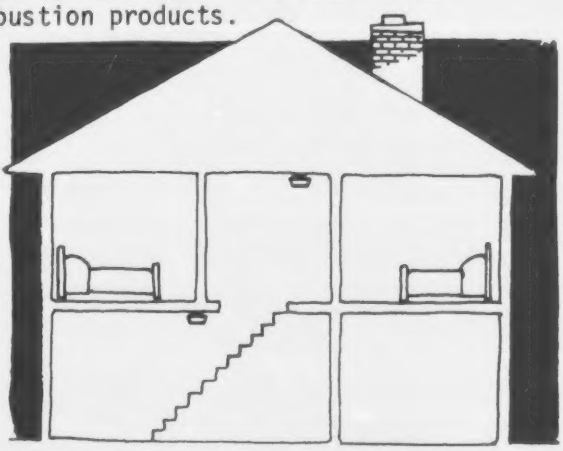
PURCHASE

1. Buy a smoke detector that has a full description of its operation, instructions for installation, and information about the expected life of its components.

2. Consider the location of electrical outlets if you buy a detector that requires a power source.

3. If you buy a photoelectric detector, it should sound a warning when the bulb burns out.

4. Some units allow for interconnection so if there is more than one detector, all units will sound the alarm when any one unit senses combustion products.



INSTALLATION

1. Put a smoke detector on or near the ceiling in places where smoke is likely to pass as it rises, such as the tops of stairs.

2. As few as one or two smoke detectors can provide a basic level of protection as long as there is one near each sleeping area.

3. Higher levels of protection can be obtained by the installation of additional smoke detectors. Normally, one unit for each level of the household will give all the protection necessary.

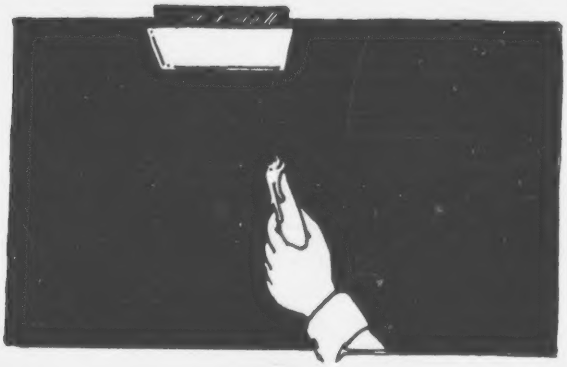
MAINTENANCE

1. Replace batteries at least once a year.

2. Replace photoelectric bulbs when they burn out.

3. Test detector monthly and when returning from vacation or any other absence of seven or more days.

If you have a smoke detector(s), sleep with your bedroom doors open.



Once every month, hold
a candle six inches under
the detector to test.

Major Appliances: Space Heaters

Burns and carbon monoxide poisoning are among the more serious injuries. Be aware of the following hazards when buying and using space heaters.

1. Carbon monoxide poisoning-an unvented or improperly vented space heater can produce deadly quantities of carbon monoxide.
2. Contact with flame, heating element or hot surface area can cause clothing to catch fire and serious burns.
3. Explosion of accumulated gas while attempting to light or re-light the burner.
4. Electrical shock, often because the victim was wet and touched the heater.

SELECTION

1. Older unvented heaters may not have the safety devices required by recent voluntary industry standards.
2. Buy a space heater with a guard around the flames or heating coils.
3. Be sure that it has an automatic switch which cuts off power if heater is tipped over.

GENERAL USAGE

1. Carefully read labels and instructions before installing and using.
2. Keep children away from space heaters.
3. Check local codes and make sure you have met installation requirements.
4. Be aware that mobile homes require specially designed heating equipment.

MAINTENANCE

1. Have inspected annually to insure that they are properly adjusted and clean.
2. Keep all electrical wiring in a good working condition.
3. Replace loose or missing guards.
4. Keep chimney's clear of bird nests and soot.

A SPACE HEATER FOR EVERYONE

Type	Description	Potential Hazard
KEROSENE	Unvented or vented through stove pipe or chimney. Open flames possible. Still popular in rural areas.	Fire Clothing ignition Flash fire Poisonous fumes Explosion Hot surfaces
GAS-FIRED	Some give off red glow. Direct heating or gas flames directed to porcelain device that radiates and stores heat. Can be vented or unvented.	Fire Poisonous fumes Explosion Clothing ignition Hot surfaces
ELECTRIC	Rectangular. Long narrow coils give off heat. Often contains fan. Automatic, thermostatic, and/or fan controls.	Shock Fire Clothing ignition Hot surfaces
SOLID FUEL BURNING	Free standing. Burns wood, coal, other solid fuels. Fireplace most common example.	Fire Smoke Clothing ignition Poisonous fumes Hot fumes

WHAT IS YOUR "FLAME-ABILITY QUOTIENT" FOR SPACE HEATERS?

Are you using and maintaining your space heater in the safest way possible? Answer the following questions-yes or no- and calculate your FAQ...your ability to prevent unwanted fire, burns, or shock. (Scoring information appears below the last question.)

Yes___ No___ 1. If you must use an unvented space heater, do you keep a window or door at least partially open?

Yes___ No___ 2. Do you light the match before you turn the gas heater on?

Yes___ No___ 3. Have you taught your children about the danger of playing near space heaters?

Yes___ No___ 4. Have you ever used charcoal in a heating stove?

Yes___ No___ 5. Is your space heater inspected, cleaned, and adjusted regularly?

Yes___ No___ 6. Do you use an electric space heater near water sources-such as in the bathroom or kitchen?

Yes___ No___ 7. Is there at least three feet of clearance between your heater and any flammables in the room (drapes, furniture, magazines, etc.)?

Yes___ No___ 8. Have you placed your space heater in a frequently used traffic lane?

Yes___ No___ 9. Do you know the proper fuel to use in your heating device?

Yes___ No___ 10. Have you ever substituted fuels for convenience (coal in a wood burning stove, oil in a kerosene heater, etc.)?

Yes___ No___ 11. Do you keep the damper open while fuel is burning in your space heater?

Yes___ No___ 12. Are there loose or missing guards on your space heater?

Yes___ No___ 13. Do you wait until all ashes are cooled before you dispose of them?

Yes___ No___ 14. Have you ever fallen asleep with an unvented heater operating?

Yes____ No____ 15. Do you use or store flammable liquids near the heater?

Yes____ No____ 16. Have you ever filled a warm space heater with cold oil?

Yes____ No____ 17. If your heating device has open flame, is there a metal screen around it?

Yes____ No____ 18. Is your space heater serviced every year?

Yes____ No____ 19. Does your electric heater have a thermostat control and an automatic shut-off device?

Yes____ No____ 20. Did you ever have an accident that was associated with a space heater?

ANSWERS-You should have answered "yes" to questions 1, 2, 3, 5, 7, 9, 11, 13, 17, 18, and 19. For the remaining questions, the safest answer should have been "no." Tally up your score, giving yourself 10 points for each correct answer.

EVALUATING YOUR FAQ:

200 points-Congratulations! Keep warm and happy. You're a real winner.

160-190 points-You're doing pretty well. Find out your weak spots and clear them up.

120-150 points-Be prepared for some trouble tomorrow unless you make some inportant changes today.

Below 120 points-Change your habits or install central heating. There are some cold winters ahead!

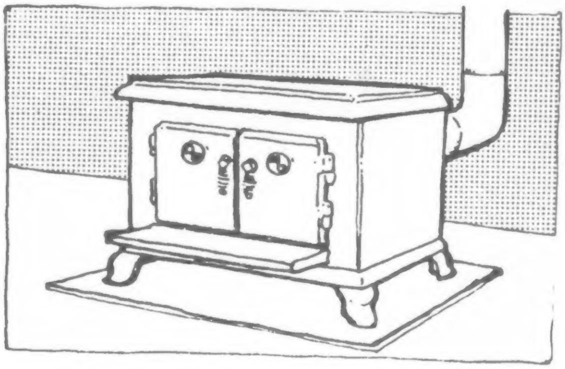
It is estimated that over 5,800 people went to hospital emergency rooms in 1977 because of injuries related to space heaters. Clothing in contact with heating elements or flames can catch fire, leaking gas can cause explosions, and carbon monoxide from a malfunctioning, poorly vented or unvented gas heater can cause death.

GENERAL SAFETY TIPS FOR ALL SPACE HEATERS

1. Read the label and follow the instructions for installation and operation.
2. Keep papers, clothing, furniture, and especially children away from space heaters.
3. Keep the heater in safe working condition. Replace missing guards and controls at once.

SAFETY TIPS FOR KEROSENE, OIL, OR WOODBURNING SPACE HEATERS

1. These too must be properly vented, to prevent the accumulation of carbon monoxide.
2. Use only the fuel for which the heater was designed. Don't use kerosene in an oil heater, and vice versa.
3. Never use highly flammable liquids like gasoline to get a wood stove started.
4. These heaters have open flames: keep flammable liquids and fabrics away.



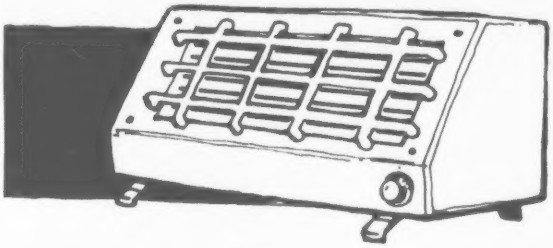
SAFETY TIPS FOR ELECTRIC SPACE HEATERS

1. Free-standing electric heaters should have tip-over switches to shut off the current if the unit is knocked over. This helps prevent ignition if the heater happens to fall against fabric or other flammable materials.

2. There must be a guard around the coil of your heater. A wire grill or other protection to keep fingers or fabrics from touching the hot elements.

3. If you must use an extension cord, make sure it's marked with a power rating at least as high as that on the label of the heater itself.

4. Keep it away from water! Don't use a portable electric heater anywhere in a bathroom or near a sink.



SAFETY TIPS FOR GAS SPACE HEATERS

1. Your gas space heater must be properly vented. This means it must have a vent pipe, of the proper size, that is free of leaks and blockages. Joints must be tight and both the heater and the vent pipe must have no cracks through which deadly carbon monoxide might leak out. An undersized or clogged vent is equally hazardous. If you're not absolutely certain that your heater and vent are in good condition, have them checked by a professional.

2. If you must use an unvented heater, keep a door or window slightly open at all times. Good ventilation during use is crucial!

3. Light the match before you turn on the gas, to prevent accumulation of gas which could flare up when you finally do bring the match near.

4. Remember that a space heater can ignite flammable liquids and vapors. Never use a space heater in the same room where gasoline is stored, or where paint thinners, kerosene, or other volatile liquids are being used.

Major Appliances: Upholstered Furniture

Most injuries associated with burns are received from upholstered furniture. Some factors involved in these furniture fires are:

1. Cigarette ignition - most common cause.
2. Drinking alcohol - and smoking, and fall asleep while on furniture.
3. Smoke and toxic gas - upholstered furniture fires tend to smolder for hours before burning.
4. Ignition by a nearby flame or heat source.

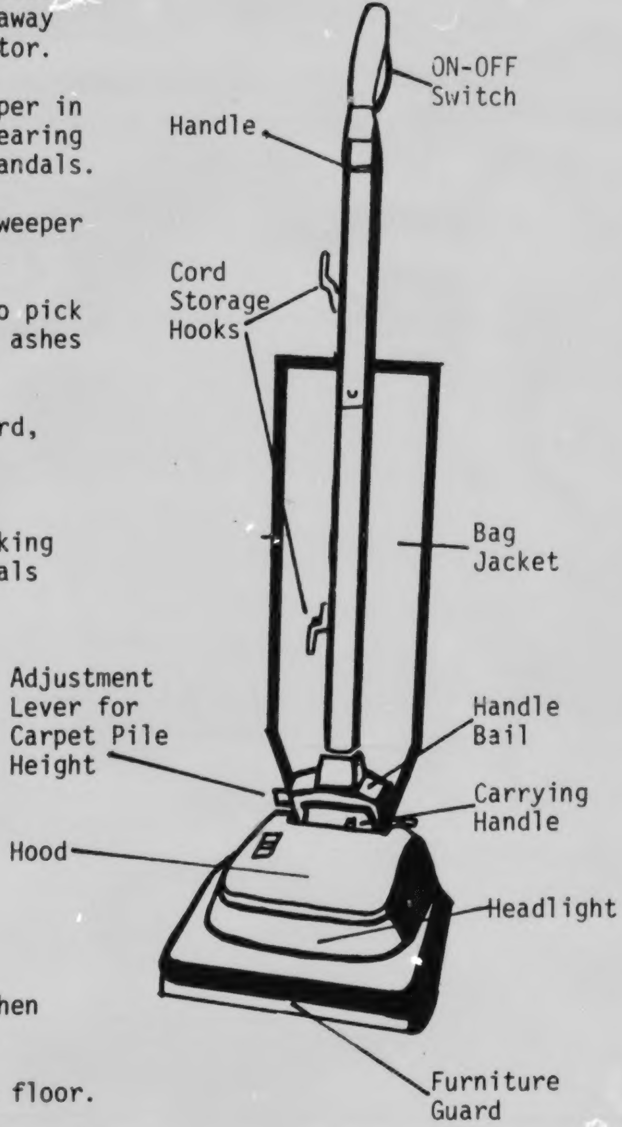
Follow these recommendations to help prevent injuries.

1. Place furniture well away from ignition sources and examine nearby electric cords.
2. Be careful about smoking when you're sleepy.
3. Use ashtrays which are deep and have wide sides and keep ashtrays off furniture.
4. If you drop a cigarette, retrieve it immediately.
5. Put out all cigarettes in ashtrays before going to sleep at night.

Major Appliances: Vacuum Sweeper

SAFETY PRECAUTIONS

1. Keep hands, feet, loose clothing, and hair away from rotating agitator.
2. Do not operate sweeper in bare feet or when wearing open toe shoes or sandals.
3. Do not run vacuum sweeper over the cord.
4. Do not use vacuum to pick up matches, or live ashes or cigarette butts.
5. Avoid picking up hard, sharp objects.
6. Change sweeper bag frequently when picking up very fine materials such as powder.
7. Never vacuum liquids.
8. Never vacuum carpeting that is damp or wet.
9. Never allow children to use vacuum as a toy.
10. Use extra caution when cleaning on stairs.
11. Keep machine on the floor.
12. Never leave machine running when unattended.
13. Store vacuum promptly after using.


ON-OFF Switch
Handle
Cord Storage Hooks
Bag Jacket
Adjustment Lever for Carpet Pile Height
Handle Bail
Carrying Handle
Hood
Headlight
Furniture Guard

LAUNDRY EQUIPMENT

Clothes Dryer

The following hazards are associated with clothes dryers.

1. Child entrapment - children can get trapped inside dryers because they panic or are unable to push open the door.
2. Fires - failure to clean the lint trap.
3. Carbon monoxide - gas produces carbon monoxide and other poisonous gases when it burns. Gas dryers should be properly vented to the outside to avoid possibly hazardous accumulations of these gases.
4. Electric shock - if not properly grounded.

To reduce risks with clothes dryers.

SELECTION

1. Be sure dryer has a safety start button on the control panel.
2. Dryer should have a door that can be opened easily from the inside.
3. Be sure electrical house wiring and the circuit that you will be using can carry the current required.

USE

1. If using anti-static compounds, do not spray substances directly on or near the electric coils.
2. Exhaust all gas dryers directly to outside, not to chimney.
3. Do not overload because heavy, wet laundry can impede the drum motion and overheat.
4. Follow suggested drying techniques in owner's manual.

5. Be sure dryers are grounded by a three-prong plug and a properly grounded outlet.

6. Have dryer checked immediately if any shock sensation is given upon touching.

7. If gas dryer has pilot light, be aware that the gas is highly flammable.

8. Do not dry items which have been used with kerosene, gasoline, oil, spot removers, turpentine, alcohol, household or other chemical cleaners because flammable vapors could ignite and cause a fire.

9. Some fabrics should never be tumble dried:

   - chemically impregnated fabrics
   - rubber
   - garments cleaned with dry cleaning fluids

MAINTENANCE

1. Keep the lint trap clean.

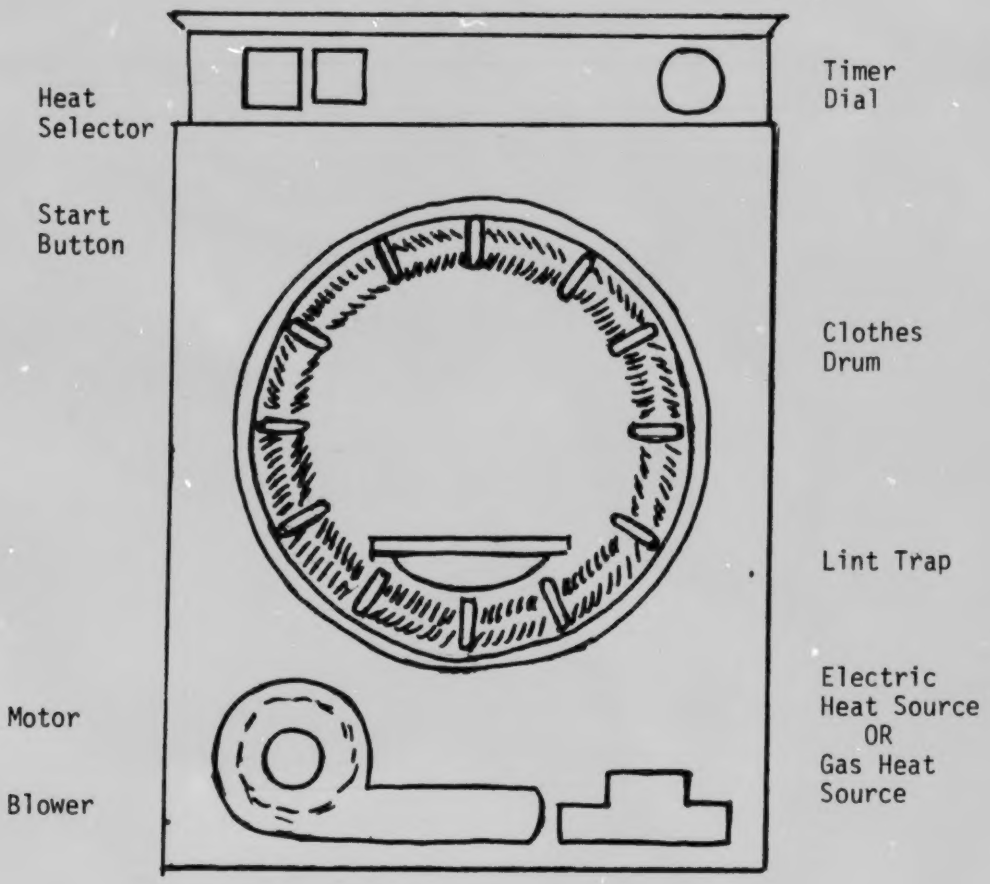
2. Check the exhaust piping for leaks.

3. If dryer isn't drying as fast as it once did, check for excess lint in dryer vent.

4. Make sure dryer is level.

5. Be sure to turn off gas valve before servicing a gas dryer.

CLOTHES DRYER


Heat Selector
Start Button
Motor
Blower
Timer Dial
Clothes Drum
Lint Trap
Electric Heat Source OR Gas Heat Source

Heat selector--used to select desired heat setting.

Start button--allows dryer to begin cycle.

Motor--turns the drum and drives the blower.

Blower--the spinning blades of the blower pull air by the heat source, through the rear of drum, across the clothes where it evaporates the moisture, and then pushes it out the exhaust duct.

Timer dial--used to select cycle and drying time desired.

Major Appliances: Clothes Dryer

Drum--where clothes are placed.

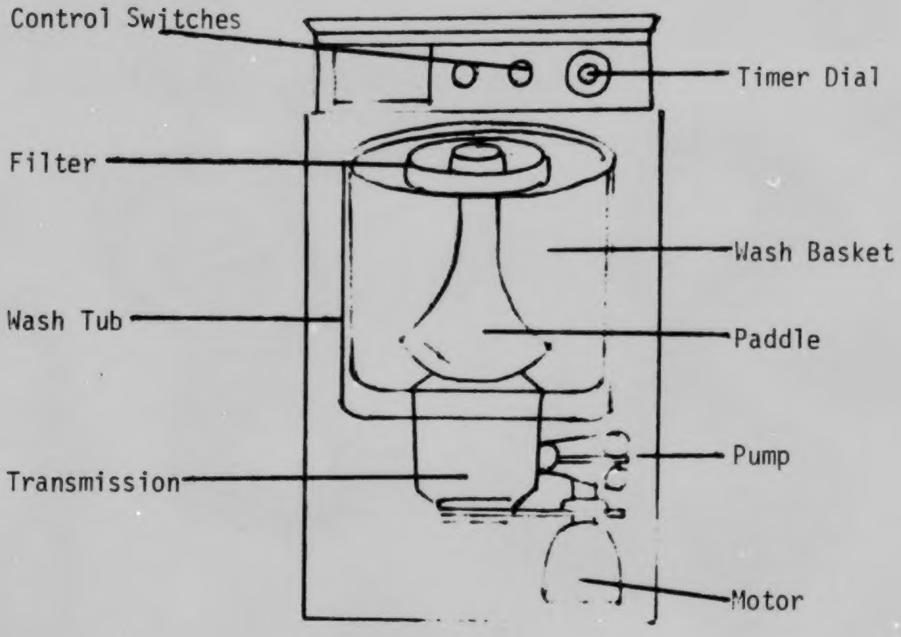
Lint trap--collects lint, fuzz, threads, etc.

Heat source, electric--located behind preforations at rear of dryer.

Heat source, gas--burner is located behind access door at lower right side of dryer.

Major Appliances: Clothes Washer

CLOTHES WASHER


Control Switches
Timer Dial
Filter
Wash Basket
Wash Tub
Paddle
Pump
Transmission
Motor

Control switches - switches that select water levels, temperatures, and wash/spin speeds.

Filter - circulates water through filter pan to collect lint.

Wash tub - outer tub in which basket sits.

Major Appliances: Clothes Washer

Transmission--gears that take power from motor and transmits it to the paddle and to wash basket.

Timer dial--used to select the cycle and wash time desired.

Wash basket--where clothes are placed.

Paddle--moves the water to clean your clothes.

Motor--powers the pump and the transmission.

Pump--pumps water through filter system and pumps water out into the drain.

SAFETY PRECAUTIONS

1. Never, for any reason, reach into a washer while it is moving.
2. When load is finished washing, wait until machine has completely stopped before unloading.
3. Always remove filter pan before adding forgotten items.
4. Never use cleaning fluids of any kind.
5. Never wash any fabrics which contain flammable materials.

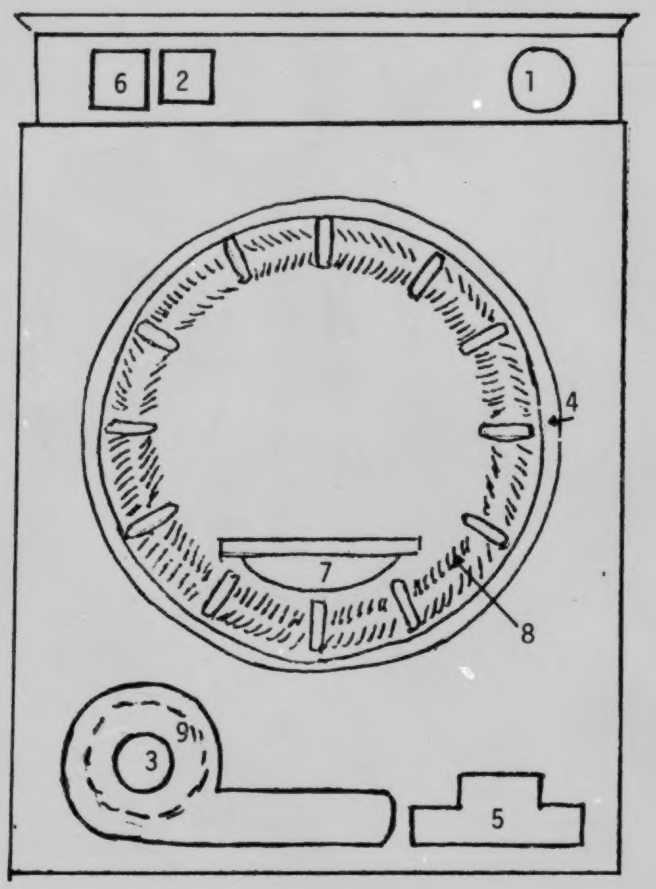
SAFETY QUIZ

LAUNDRY EQUIPMENT

Name______________________________
Date______________________________

Identify the parts of this clothes dryer.

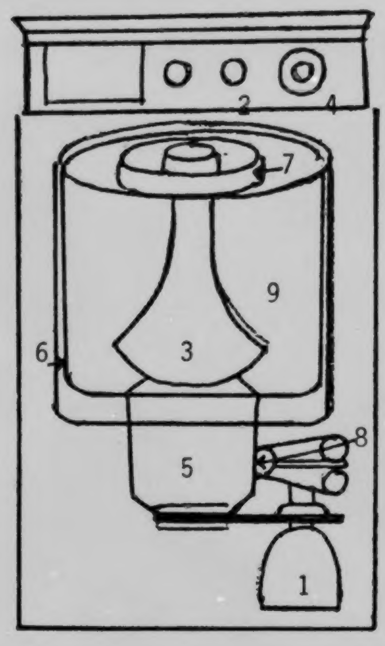
1. ____________________
2. ____________________
3. ____________________
4. ____________________
5. ____________________
6. ____________________
7. ____________________
8. ____________________
9. ____________________



Safety Quiz: Laundry Equipment continued

Identify the parts on this clothes washer.

1. ____________________
2. ____________________
3. ____________________
4. ____________________
5. ____________________
6. ____________________
7. ____________________
8. ____________________
9. ____________________



SHORT ANSWER

1. Failing to keep the lint trap clean could result in a _______________.

2. Put a check mark by the features that should be considered before purchasing a dryer. Leave space blank if it does not apply.

   ______________ Correct wiring in house where it's to be used.

   ______________ Safety start button.

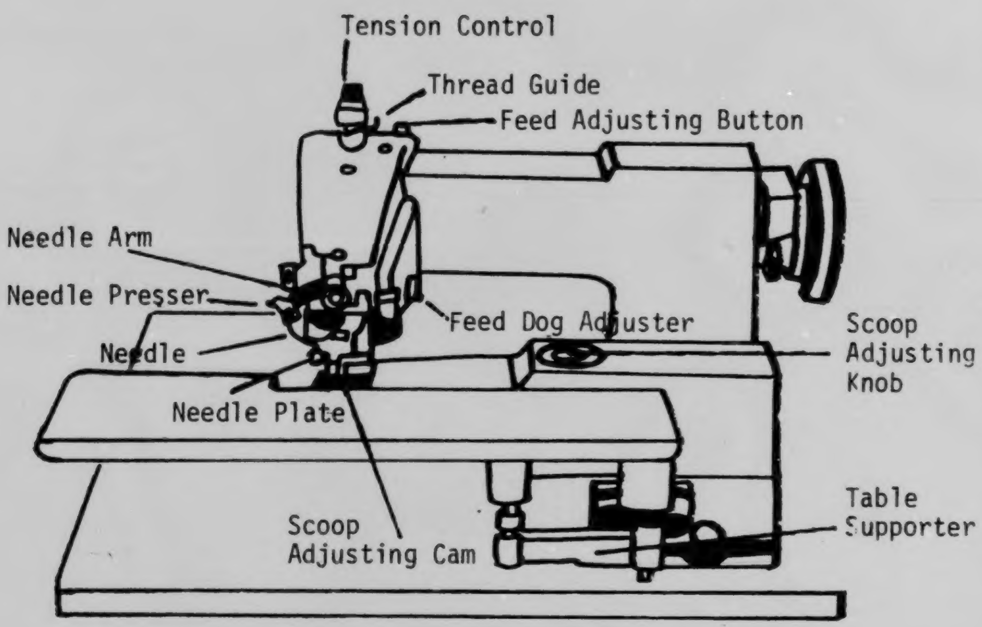
   ______________ Door that is easily opened from inside.

3. TRUE or FALSE - It is acceptable to add clothing to the wash cycle after the washer has been started without first turning the machine off. _______________

4. TRUE or FALSE - It is acceptable to wash fabrics that contain flammable materials. _______________

SEWING MACHINES

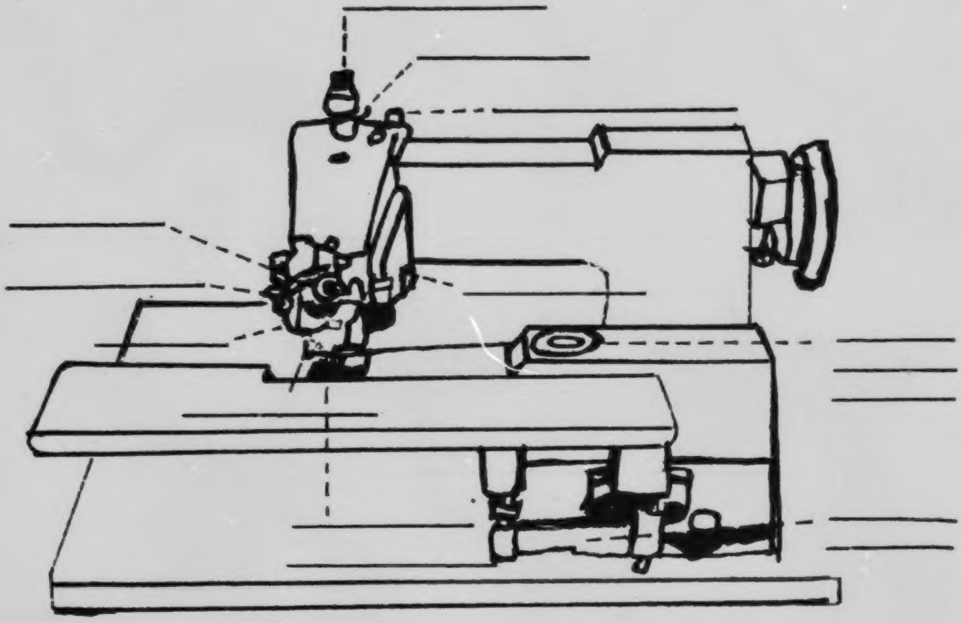
BLINDSTITCHER


Tension Control
Thread Guide
Feed Adjusting Button
Needle Arm
Needle Presser
Feed Dog Adjuster
Scoop Adjusting Knob
Needle
Needle Plate
Table Supporter
Scoop Adjusting Cam

Sewing Machines

BLINDSTITCHER QUIZ

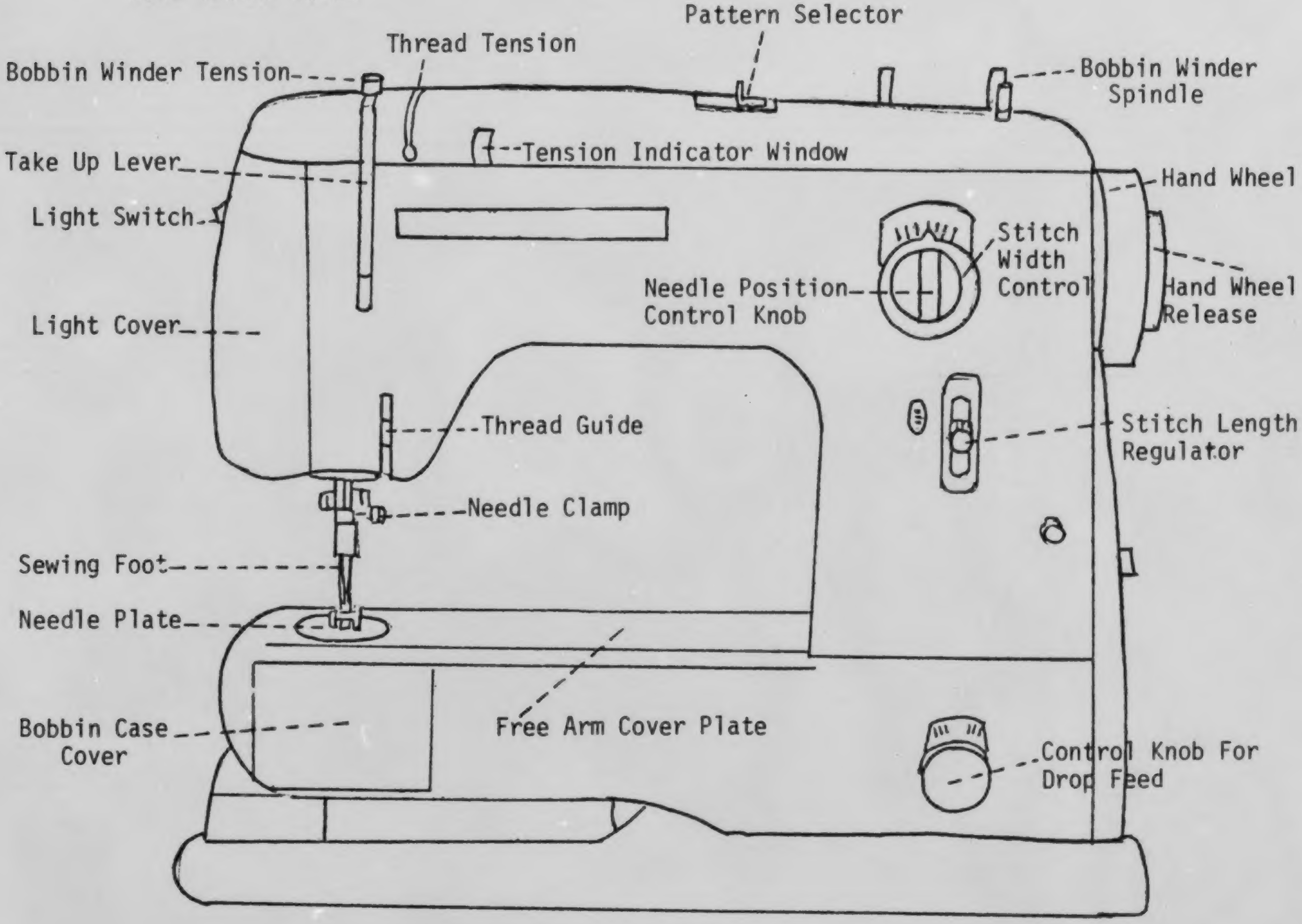
Identify each of the parts by placing the correct name in the space provided.

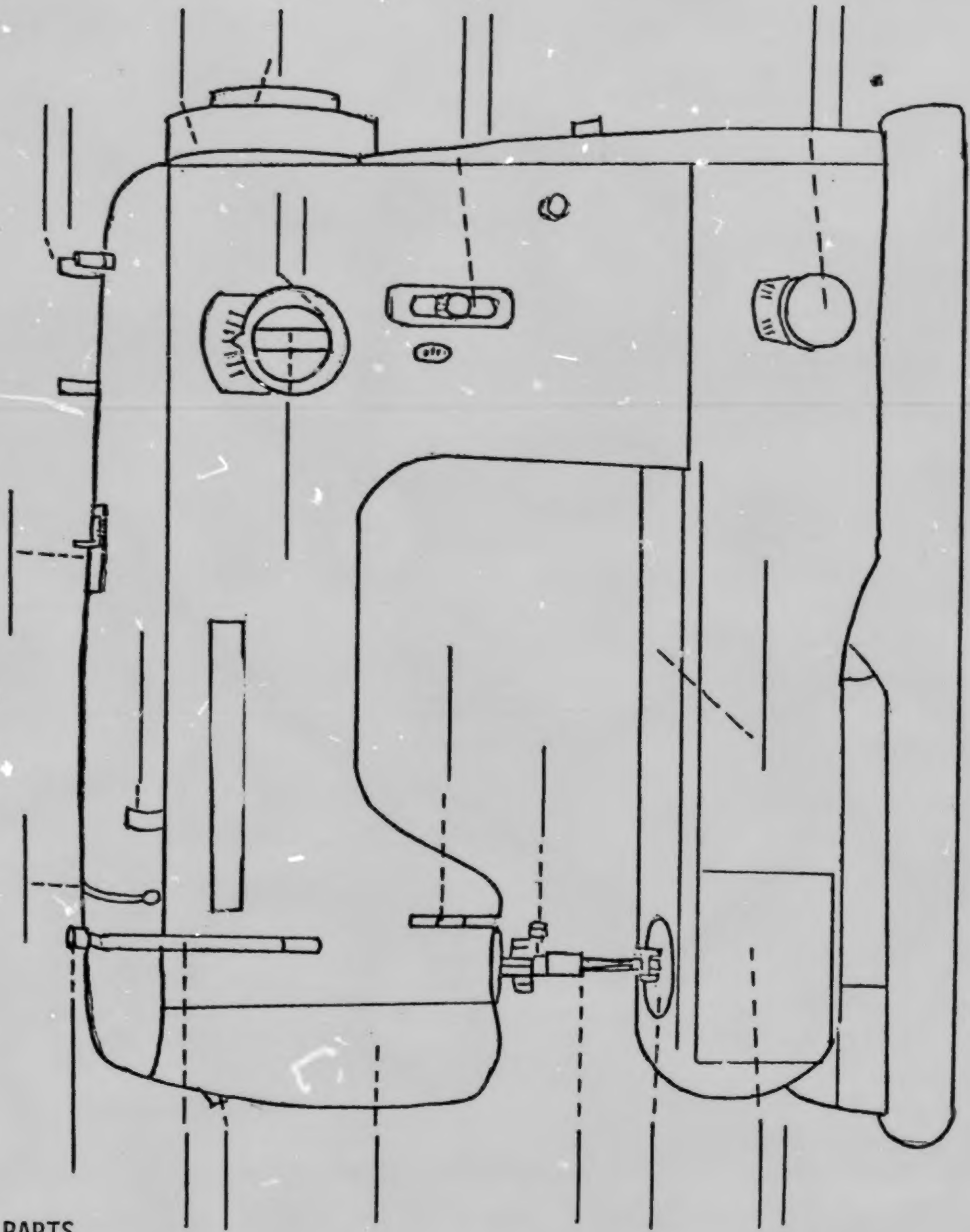


PARTS

- Tension Control
- Thread Guide
- Feed Adjusting Button
- Feed Dog Adjuster
- Scoop Adjusting Knob
- Table Supporter
- Scoop Adjusting Cam
- Needle Plate
- Needle
- Needle Presser
- Needle Arm

HOME SEWING MODEL


Pattern Selector
Thread Tension
Bobbin Winder Tension
Bobbin Winder Spindle
Tension Indicator Window
Take Up Lever
Hand Wheel
Light Switch
Stitch Width Control
Needle Position Control Knob
Hand Wheel Release
Light Cover
Thread Guide
Stitch Length Regulator
Needle Clamp
Sewing Foot
Needle Plate
Bobbin Case Cover
Free Arm Cover Plate
Control Knob For Drop Feed

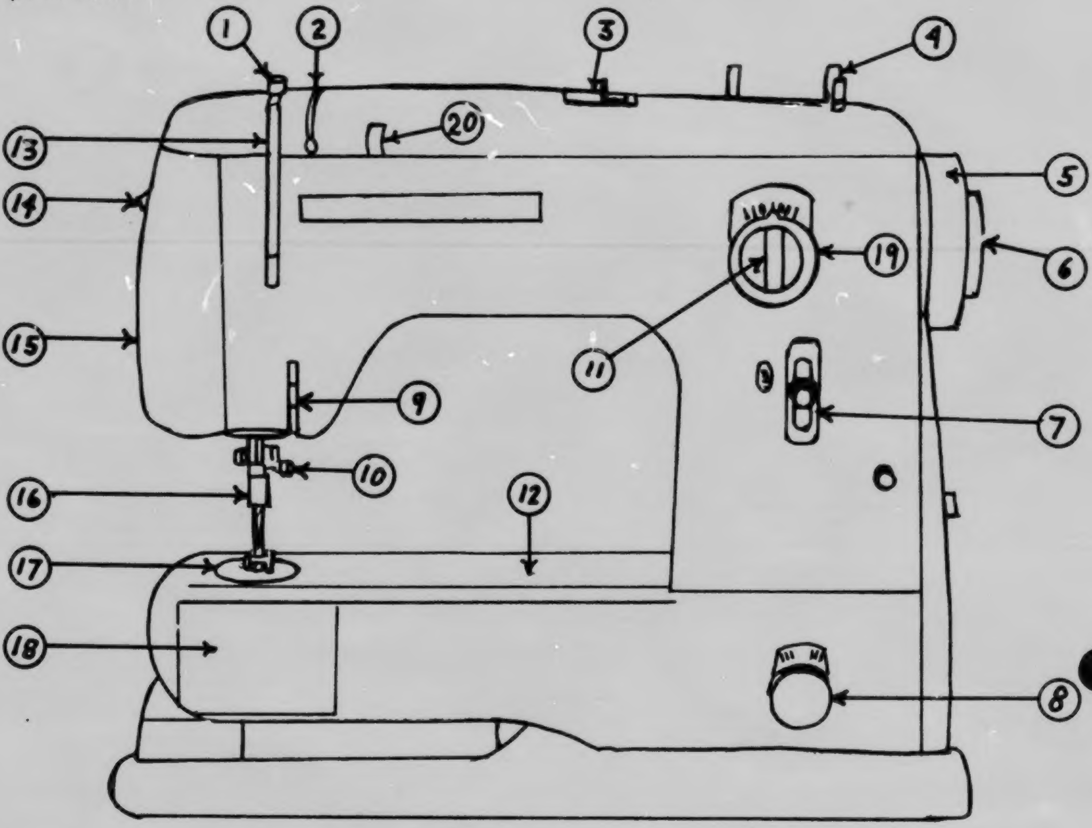


PARTS

- Bobbin Winder Tension
- Take Up Lever
- Light Switch
- Light Cover
- Sewing Foot
- Needle Plate
- Bobbin Case Cover
- Tension Indicator Window
- Free Arm Cover Plate
- Needle Clamp
- Thread Guide
- Needle Position Control Knob
- Stitch Width Control
- Pattern Selector
- Control Knob For Drop Feed
- Stitch Length Regulator
- Handwheel Release
- Handwheel
- Bobbin Winder Spindle
- Thread Tension

Sewing Machines
HOME SEWING MODEL QUIZ

Identify each of the parts by placing the correct name in the space provided.


1
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1. ____________________
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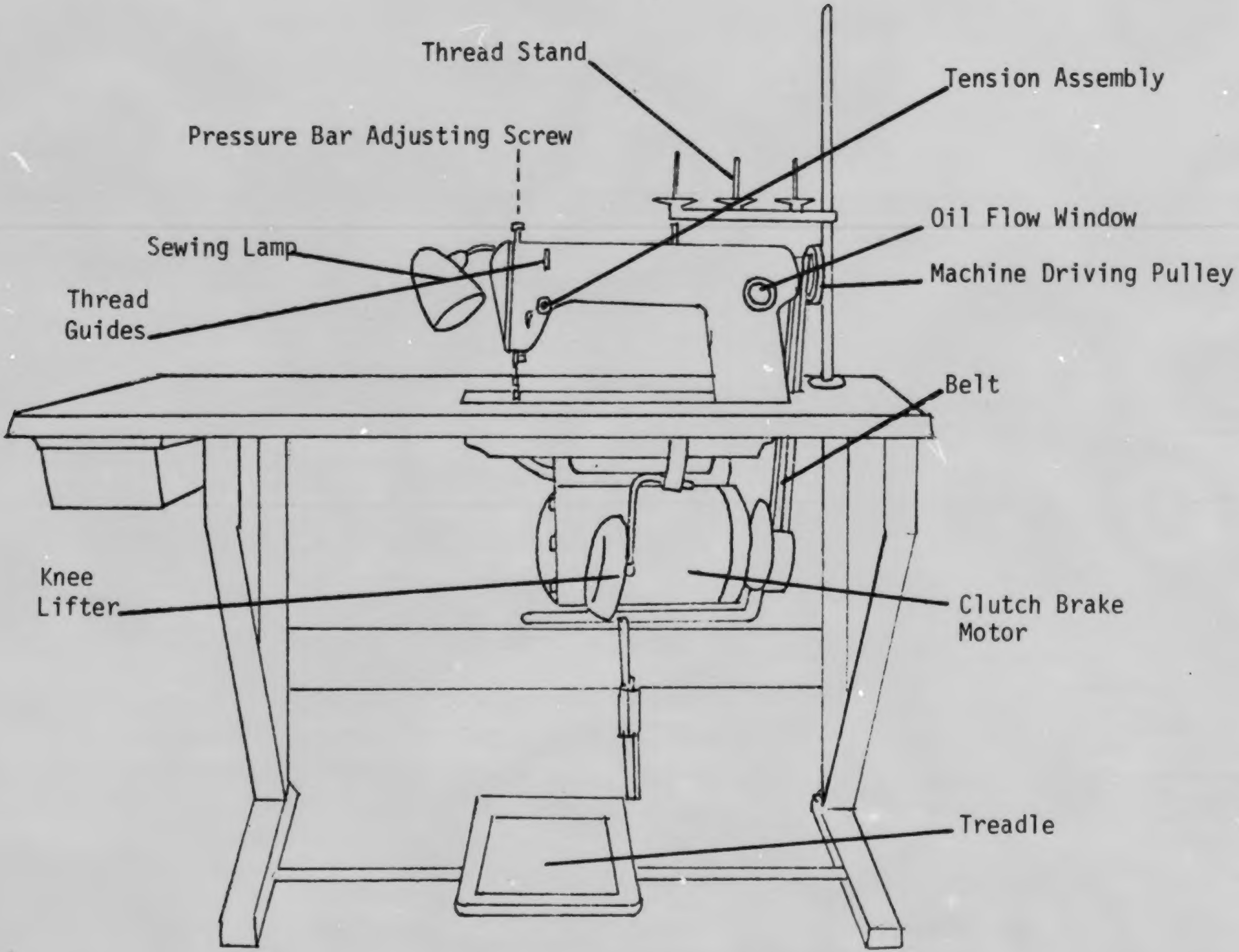
11. ____________________
12. ____________________
13. ____________________
14. ____________________
15. ____________________
16. ____________________
17. ____________________
18. ____________________
19. ____________________
20. ____________________

POWER-DRIVEN LOCKSTITCH MACHINE


Thread Stand
Tension Assembly
Pressure Bar Adjusting Screw
Sewing Lamp
Oil Flow Window
Machine Driving Pulley
Thread Guides
Belt
Knee Lifter
Clutch Brake Motor
Treadle

Power-Driven Lockstitch Machine

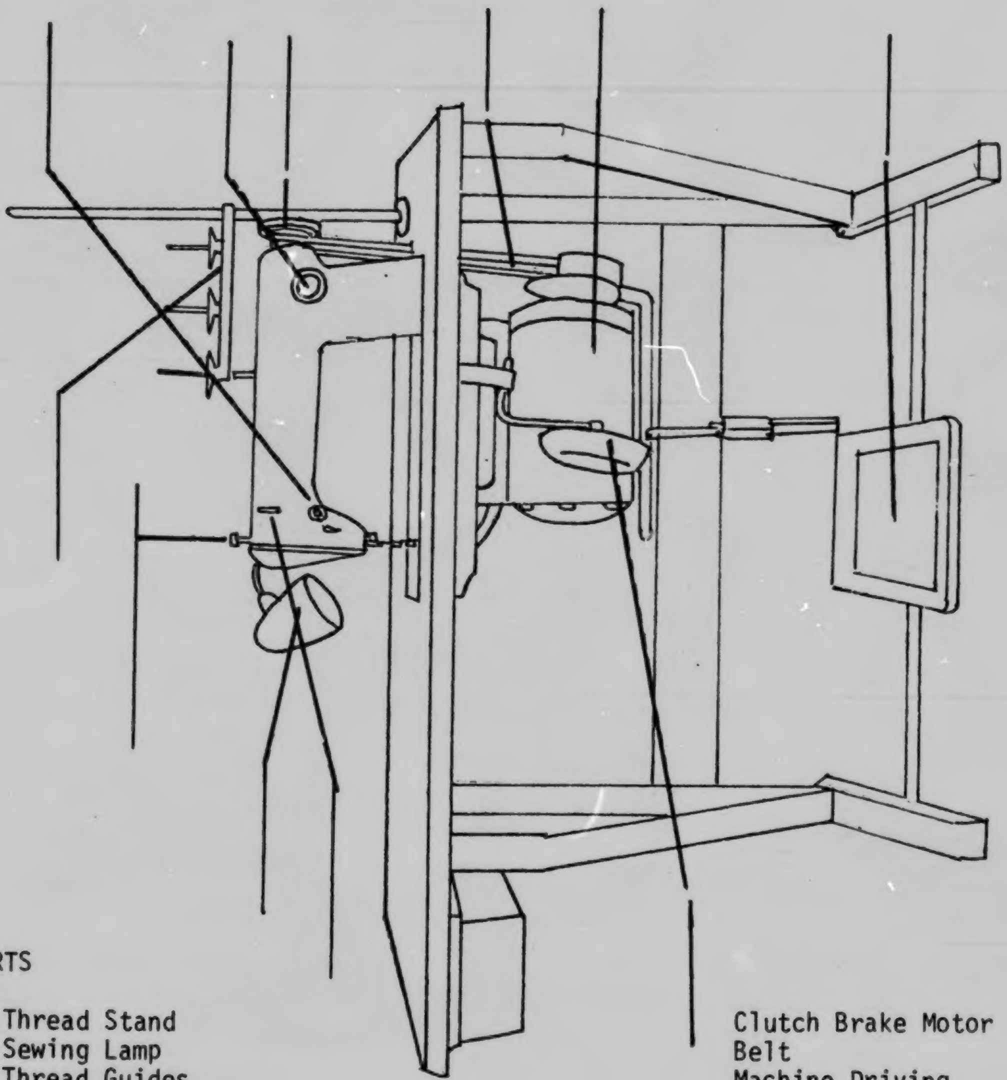
Industrial machines are heavier than home sewing machines and are capable of sewing at a much greater rate of speed. The best machine available is only as good as the operator. Because of this the importance of safety on the job cannot be overemphasized. Accident prevention is the responsibility of every machine operator. Following safe working procedures can result in personal security, increased production, and higher earnings.

The student's or operator's responsibilities include:

1. Cooperating with authorities to remedy any existing hazards.
2. Learning and obeying existing rules and regulations.
3. Preventing accidents.
4. Providing wholesome working conditions.

POWER-DRIVEN LOCKSTITCH MACHINE
QUIZ

Identify each part by placing the correct name in the space provided.

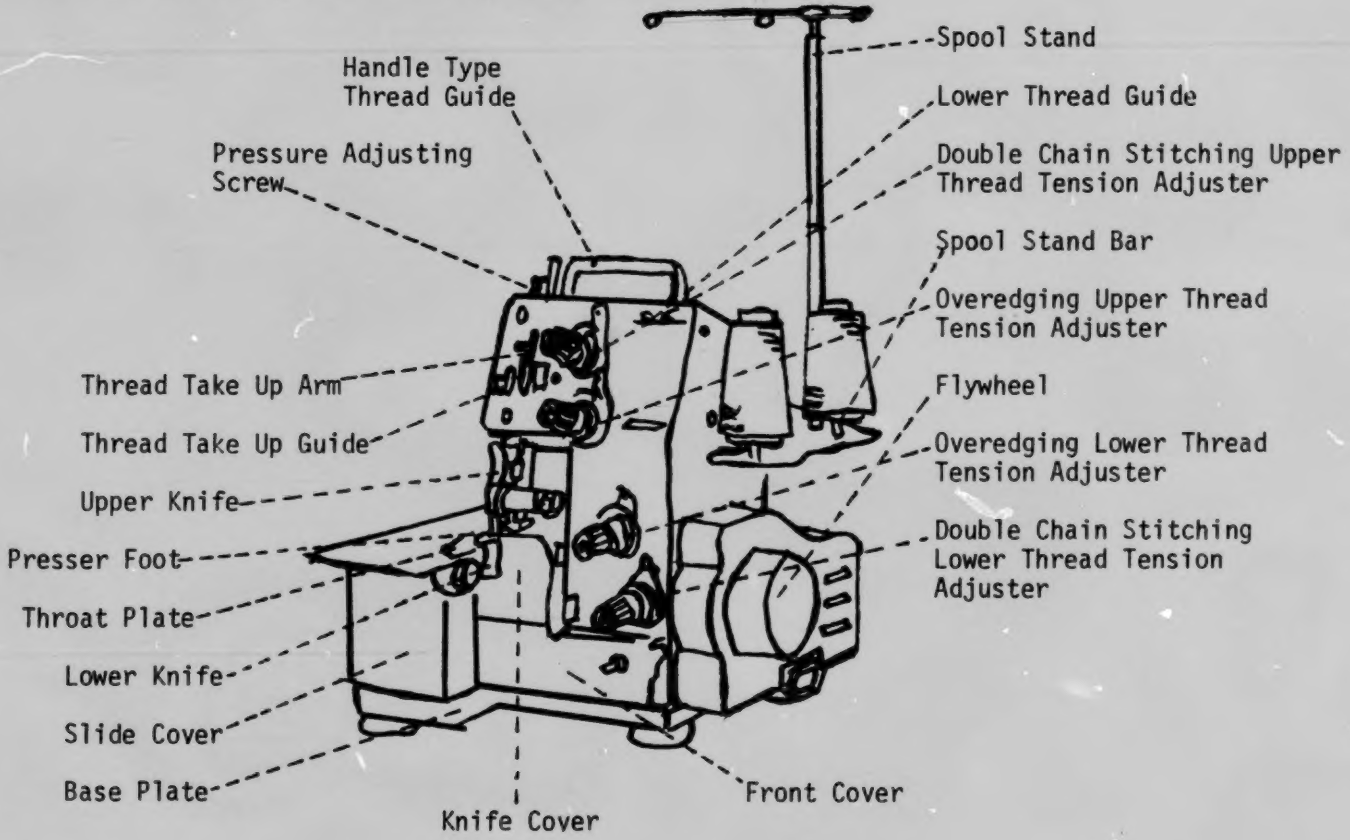


PARTS

- Thread Stand
- Sewing Lamp
- Thread Guides
- Knee Lifter
- Pressure Bar Adjusting Screw
- Treadle
- Clutch Brake Motor
- Belt
- Machine Driving Pulley
- Oil Flow Window
- Tension Assembly

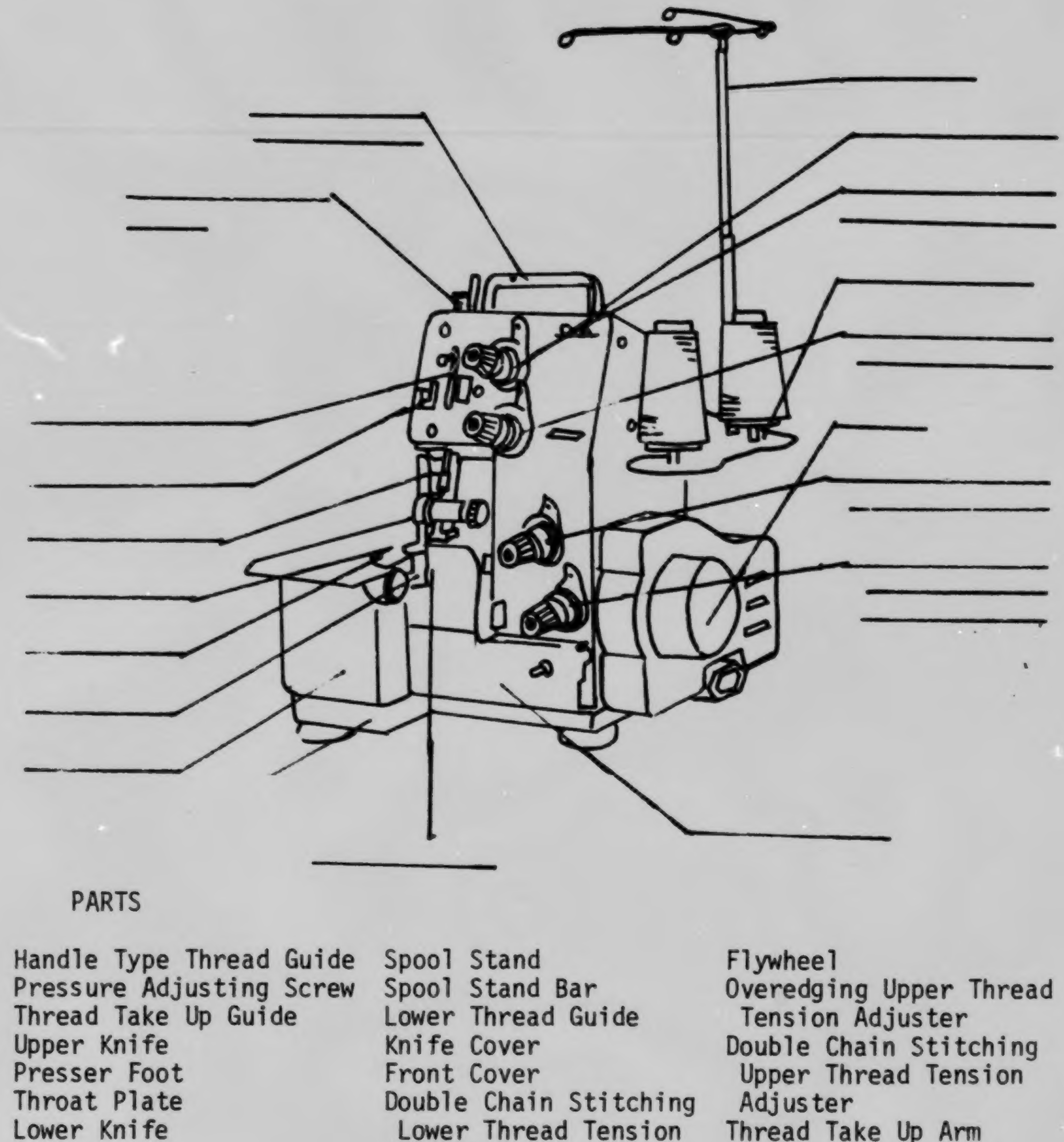
SAFETY PRECAUTIONS

1. Do not put anything on the controller.
2. Keep the plug off for safety after using.
3. Do not run pins through machine.
4. Do not touch blade more than necessary.


Handle Type Thread Guide
Pressure Adjusting Screw
Thread Take Up Arm
Thread Take Up Guide
Upper Knife
Presser Foot
Throat Plate
Lower Knife
Slide Cover
Base Plate
Knife Cover
Front Cover
Spool Stand
Lower Thread Guide
Double Chain Stitching Upper Thread Tension Adjuster
Spool Stand Bar
Overedging Upper Thread Tension Adjuster
Flywheel
Overedging Lower Thread Tension Adjuster
Double Chain Stitching Lower Thread Tension Adjuster

Sewing Machines

SERGER QUIZ



PARTS

- Handle Type Thread Guide
- Pressure Adjusting Screw
- Thread Take Up Guide
- Upper Knife
- Presser Foot
- Throat Plate
- Lower Knife
- Slide Cover
- Base Plate
- Spool Stand
- Spool Stand Bar
- Lower Thread Guide
- Knife Cover
- Front Cover
- Double Chain Stitching Lower Thread Tension Adjuster
- Overedging Lower Thread Tension Adjuster
- Flywheel
- Overedging Upper Thread Tension Adjuster
- Double Chain Stitching Upper Thread Tension Adjuster
- Thread Take Up Arm

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AUDITORIUM/STAGING EQUIPMENT

CATWALKS

Catwalks are to be maintained in a safe condition and to be constructed of approved materials with good rails. They are to be kept clear of storage or other obstructions. Any pupil or teacher using catwalks must use an approved safety harness with lanyard.

COUNTERWEIGHT SYSTEMS

The counterweight system works on the principle of a teeter-totter which distributes equal weight at the extreme ends to provide balance. The weight carriers, called cradles, hold enough weights to balance the load of the scenery which is hung on battens. The cradles must be balanced at all times, even when the lines are not in use. The cradle load is locked in place with a brake lever mounted on the rail. Pushing the lever in one direction wedges it against the rope and locks it in place. Pulling it back releases the tension so the rope can be either raised or lowered. The cradle brake must be slipped down over the brake to prevent the accidental releasing of the brake and should be in use when the line is not being adjusted.

SAFETY PLATE

The safety plate within the weight cradle must be screwed down after each adjustment is made with the weights.

THUMB SCREW

The thumb screw at the back of the endless rope brake on the locking rail must tightly adjust the endless rope when the brake is applied.

SANDBAGS

When using a single line or special line which is not a part of a counter-weight system, a sandbag must be tied on the weight end when the line is not in use.

FLYING SCENERY

To safely fly scenery on battens with a counterweight system, follow the procedure below.

1. Operate it only after instruction has been received.
2. Identify the batten to be flown with the correct line.
3. Call out in a clear voice, "Batten in" or "Batten out."
4. Release the safety ring over the brake.
5. Release the counterweight brake.
6. Pull the brake in position.
7. Return the safety ring over the brake.

ADJUSTING PROCEDURE

When adjusting weights within the cradle from a catwalk position, all persons below are required to stand clear of the area, and a person must be positioned as a safety guard on the floor to keep the area clear while loading is in progress. First, the weights should be removed from the batten line and then adjustments to balance the cradle should be made. Weights within the cradle must be made with experienced personnel only who shall be professionally supervised. To adjust counterweights in the weight cradle:

1. Operate only after instruction has been received, and the teacher or supervisor is present.
2. Identify the batten and line to be adjusted.
3. Lower the batten to be loaded or unloaded.
4. Lock the counterweight brake.
5. Return the safety ring over the brake.
6. Check to be sure the thumb screw holds the endless rope tightly.
7. Station a safety person on the floor before climbing the catwalk.

8. Be sure that the safety person calls out in a clear voice, "Clear the lock railing area," and proceeds to see that all persons have cleared this area.

9. See that the safety person clears the lock railing area, calling, "All clear."

10. From the catwalk, identify the line to be adjusted.

11. Remove the cradle weight safety plate.

12. Remove weights or add weights to the cradle, as the case may be.

13. Take weights from the catwalk or return them to the catwalk depending on whether they are being loaded or unloaded.

14. Re-secure the cradle weight safety plate.

15. Call out in a loud clear voice, "Batten loaded" or "Batten unloaded," whichever is appropriate.

16. Return from the catwalk as the safety person calls, "All clear."

17. Carefully release the safety ring on the batten and brake.

18. Check the balance of the line weighted.

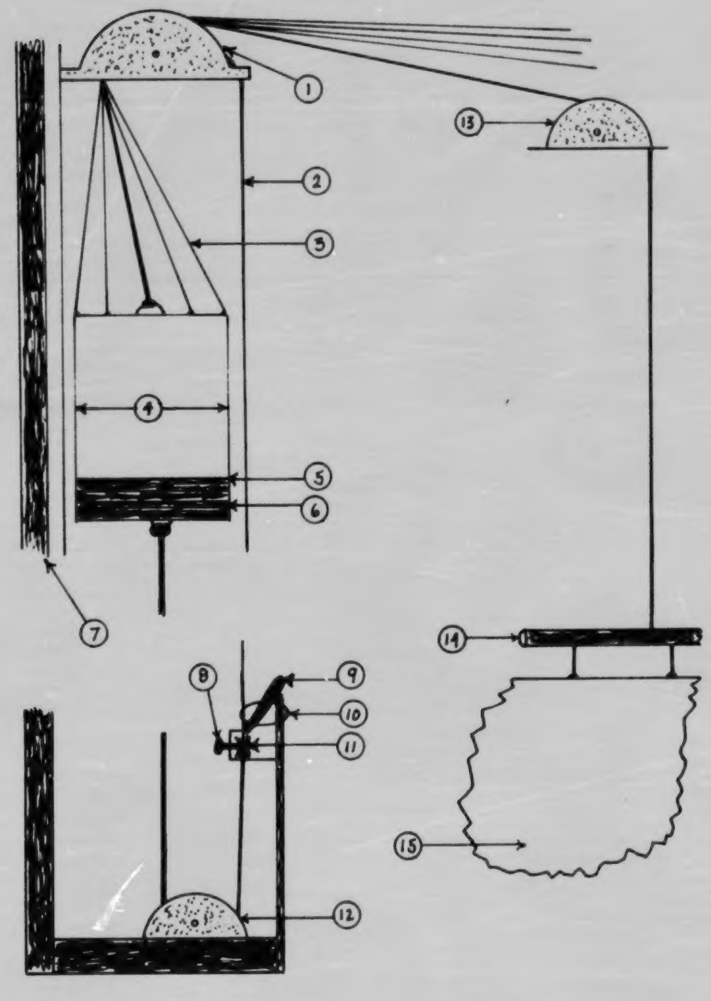
19. Repeat this procedure if more weight adjustments need to be made.

20. Any person using the catwalk must be provided a safety belt and lanyard and required to use the safety equipment.

21. Anyone working on stage equipment that is in a working position below another worker must wear a hard hat. The hat will prevent head injury.

All pupils shall be instructed and tested in the procedures of adjusting the counterweight system. Teachers can use the following test as an example. Pupils completed tests should be kept on file.

COUNTERWEIGHT SYSTEM CHART

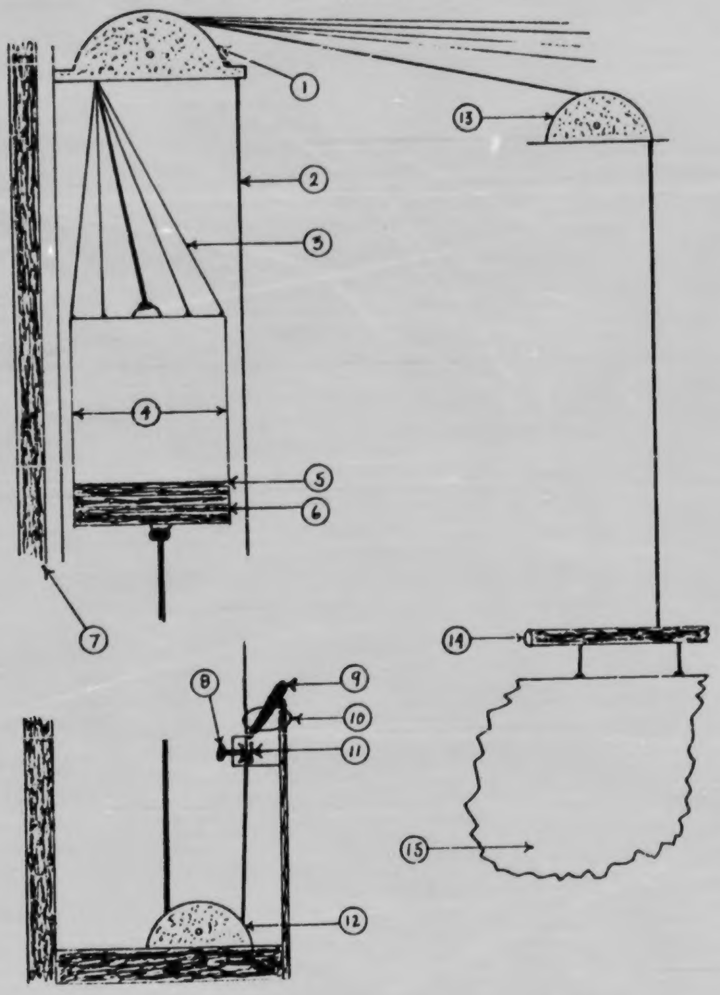


1 Head block
2 Endless line
3 Guide line
4 Cradle
5 Weight safety bar
6 Weights

7 Wall
8 Thumb screw
9 Brake
10 Safety ring
11 Lock rail
12 Sheath

13 Sheath
14 Batten
15 Scenery

COUNTERWEIGHT SYSTEM QUIZ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1 ____________________

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6 ____________________

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12 ____________________

13 ____________________

14 ____________________

15 ____________________

1. Fill in the blanks above.
2. On the back of this page, list the procedure for changing counter weights.

ELECTRICAL SAFETY

The installation and repair of electrical circuits requires the services of a licensed electrician and it must meet all electrical codes. The running of dimmer boards, setting up of stage lights, and operation of electrical equipment must all be done under the supervision of a teacher who has given the operators full instructions. A basic knowledge of electricity is essential for all persons working with stage lighting. The points listed below should be understood and practiced.

1. Each piece of electrical equipment must be used only with the voltage for which it is rated.

2. Copper, brass, and most metals are good conductors of electricity.

3. Rubber, wood, and glass are non-conductors of electricity.

4. A breaker is a safety valve which prevents the overloading of a circuit. If the breaker and the circuit are overloaded, there is danger of extreme heat at any point in a circuit which may cause a fire.

5. The short circuit is a menace, and at the first sign that one exists, (such as sparks, fuse blowing out or over-heating of the wire) the wall switch or circuit breaker should be thrown to the off position.

6. Electrician's tape or friction tape shall be used to cover bare wires.

7. All flexible cords shall be used only in continuous lengths without a splice.

8. The male portion of the connector is always connected to the lighting instrument or load while the female is always connected to the power source or line.

9. Only stage gels or rondells shall be used as a color medium for stage lighting. Do not use paper products or fabrics to change light colors.

10. Ellipsodial spotlights must have the base of the lamp burn up instead of down, as in all other spotlights.

11. Makeshift light stands or trees (i.e., metal ladders) are unsafe because they are light in weight and extremely dangerous should a short in an instrument occur.

12. All electrical plugs, wiring, insulation, connectors, and sockets used in lighting instruments must be inspected regularly. Any hazardous electrical problem requires prompt repair.

13. Small metal objects (pins, needles, nails, paper clips, thumbtacks, etc.) must be kept clear of dimmers or light boards and must never be stored on or above the light board casing.

14. Only licensed electricians shall attempt to do repair or maintenance work on light boards.

All pupils must be instructed and tested in electrical safety. Teachers can use the following test as an example. Pupils' completed tests should be kept on file.

ELECTRICAL SAFETY QUIZ

NAME ____________________

CLASS ____________________

DATE ______________ GRADE _____

(Circle true or false)

1. The best insulation for a bare electrical wire is rubber tape. T F

2. When wires are spliced together, the ends are twisted together since taping is not necessary. T F

3. It is advisable to solder connections if they are semi-permanent or temporary. T F

4. A short in a wiring system means that the electric current selects the shortest connection to complete a circuit. T F

5. Sealing wax can be used to drip onto exposed connections if you do not have tape. T F

6. It is important to know the load capacity of a wire before plugging in lighting instruments. T F

7. The fuse is merely a safety device to tell you that you have overloaded the circuit. T F

8. Flexible cords may be used if not more than one splice is made. T F

9. Silver, copper, brass and most metals are conductors of electricity because they resist the flow of current. T F

10. Porcelain, rubber, glass or wood are non-conductors because they do not resist the flow of current. T F

11. Knowing how to shut off the current is more important than knowing how to change a fuse. T F

(Circle true or false)

12. Each outlet box must have a cover or fixed canopy. T F

13. To prevent tripping, all electrical cables lying on the floor should at least be covered with duct tape. T F

14. Before fixing a short circuit, the first thing to do is to get the electric tape. T F

15. When using power tools, a person does not always have to use a three-prong grounding plug. T F

STAGE CURTAINS--FLAMMABLE FABRIC

Stage curtains and draperies shall be flameproof and be tested at least once a year. Smoking is prohibited in all stage or backstage areas. Flammable fabrics or other materials such as straw, hay, grass, and paper shall be treated with flameproof solutions before being used on stage. Open flames, such as lanterns, candles or torches are not to be used on stage.

FIXED LADDERS

Fixed ladders are to be kept free of scenery, props, costumes, or lighting equipment.

FIXED STAIRS

Fixed stair areas are not to be used for storing scenery, props, costumes, or lighting equipment. No storage is allowed under the stairs.

ORCHESTRA PITS

A safety rope guard shall be used across the curtain line when the stage does not have a toeboard, railing, or other guard, as a warning of an open orchestra pit. Curtains, carpets, or other flammable materials are to be kept out of orchestra pits unless they are flameproofed.

Pupils shall not be allowed to enter the orchestra pit after the house lights have been lowered. They must follow a pre-planned, organized means of entrance and exit.

SCAFFOLDS, RISERS, RUNWAYS

The footing or anchorage for scaffolds, risers, and runways, must be sound, rigid, and capable of carrying the maximum load intended without danger of settling or displacement. The use of barrels, boxes or blocks is prohibited. Guardrails and toeboards must be installed on all open sides and ends of platforms that are more than four feet above the ground or floor. Scaffolds, risers, or runways are to be maintained in a safe condition and are not to be altered or moved horizontally while they are in use or occupied. Risers must be properly fastened at all security points, and toeboards must be used on topsteps rising over four feet high. When folding risers are being set up, the locking latch (bar or bolt) must be in place in order to prevent the collapse of the unit.

SOUND SYSTEMS

Persons operating sound systems shall be given full instructions before using the equipment. If a sound system shows any signs of electrical fire such as visible smoke, odor of rubber burning, or sparks, the system must immediately be turned off. The malfunction shall be reported to the proper authorities but no repairs should be attempted. Should an actual fire occur, or if it is impossible to disconnect the sound system, use a CO_2 extinguisher. Do not use water.

CORAL SHELLS

Since coral shell units are very heavy, care must be used in setting them up. The top panel on a unit is hinged and could crash down if it is not handled cautiously.

STAGE FLOOR SURFACES

Stage floors are to be maintained free from hazardous splinters or slippery wax build-up. Stage floors are to be swept clean of nails, sawdust, or other working materials each day, particularly after scenery construction has taken place.

STAGE FLOOR TRAPS

Stage floor traps must be kept closed when they are not in use. A physical barrier such as a removable standard railing must be set up around an open trap as a warning of possible danger.

PIANOS

Care should be exercised when a grand or other piano is on large casters to insure that the piano is not accidentally pushed off the stage. Pianos should always be moved slowly and cautiously. Studio pianos must be pushed end-to-end, NOT front-to-back in order to prevent upsetting.

INDUSTRIAL EQUIPMENT

Machine guarding is of the utmost importance in protecting persons from the hazards associated with operating machinery. If fact, it could be said that the degree to which machines are guarded in an establishment is a reflection of the management's interest in providing a safe work place.

People cannot always be relied upon to act safely when they are around machinery in motion. This often causes accidents. From time to time, they will react differently to the same environment because of physical, mental, or emotional changes--sometimes reacting safely, sometimes not. It follows that even the well-coordinated and highly trained person may at times perform unsafe acts which could lead to injury and death. Proper guarding will allow the teacher/pupil to work safely, and at the same time perform his/her assigned tasks.

The basic types of mechanical action or motion which must be guarded are found in many of the machines used in schools and industries. Once this fact is recognized and understood, it is possible to effectively evaluate the machinery safeguarding needs in any type of industrial activity, in terms of the situation involved.

This unit will first discuss the principles of mechanical guarding and will then outline certain broad principles of mechanical guarding applicable to all guarding situations. This will be followed by illustrations showing the techniques of mechanical guarding as applied to specific machines.

No attempt has been made to distinguish between the merits of the various methods of guarding the same situation. Production requirements, size of the stock, handling methods, personal preference, and other elements may be of importance in making the final decision. An attempt has been made, however, to illustrate only those techniques which are current practices in the trade.

In a number of states, rules and regulations specify the types of safeguards to be provided for hazardous machinery. In all such cases, these rules or regulations should be observed. Guards should also be made as attractive as possible. Well-designed, well-made guards, attractively painted, add to the appearance of the laboratory.

It is one thing to say, "This machine should be safeguarded," and another to explain how it can be effectively guarded. To make it possible for the users of this section to get the most practical suggestions as to how safeguarding may be accomplished, various techniques are illustrated in order to stimulate ingenuity and imagination. By understanding the basic techniques for guarding simple machinery, one is better able to cope with the problems involving more complex machinery. There can be no question as to the value of guarding machinery. Any moving part creates a hazard, and guarding eliminates or controls the hazard.

GENERAL REQUIREMENTS FOR MACHINE GUARDING (OSHA)

One or more methods of machine guarding shall be provided to protect the operator and other pupils in the machine area from hazards such as those created by point-of-operation, ingoing nip points, rotating parts, flying chips, and sparks.

Guards shall be affixed to the machine where possible, and secured elsewhere, if for any reason attachment to the machine is not feasible. (OSHA)

The guard shall be such that it does not offer an accident hazard in itself.

The point-of-operation of a machine, whose operation exposes an employee or pupil to injury, shall be guarded. The guarding device shall be in conformity with any appropriate standards or, in the absence of applicable specific standards, shall be so designed and constructed as to prevent the operator from having any part of his/her body in the danger zone during the operating cycle.

Special hand tools for placing or removing material shall be such as to permit easy handling of the material without the operator placing a hand in the danger zone. Such tools shall not be in lieu of other guarding required by this section, but can only be used to supplement the protection provided.

Machinery designed for a fixed location shall be securely anchored to prevent walling or moving.

All fan blades, belts, chain devices, shaftings, couplings, kegs, collars, and clutches located seven feet or less above the ground, floor, or working platform must be effectively guarded to prevent accidental contact. V-belts and chain drives must be completely enclosed. (NIOSH/OSHA)

The following are some of the machines which require point-of-operation guarding: (a) guillotine cutters, (b) shears, (c) alligator shears, (d) power presses, (e) milling machines, (f) power saws (g) jointers, (h) portable power tools, and (i) forming rolls and calenders.

THE PRINCIPLES OF MECHANICAL GUARDING

(INDUSTRIAL MACHINERY)

All mechanical action or motion is hazardous, but in varying degrees. Rotating members, reciprocating arms, moving belts, meshing gears, cutting teeth, and parts in impact or shear are some examples of types of action and motion requiring protection. They are not peculiar to any one machine or industry, but are basic to the mechanical devices used for productive purposes.

ACTIONS AND MOTIONS THAT CREATE HAZARDS

Since it is not possible to formulate safety standards which will cover every conceivable hazardous mechanical exposure, it is often necessary to use imagination and ingenuity to protect a worker in unusual situations. If the basic hazardous actions and motions are understood, it is easier to evaluate the hazard and to develop effective control measure, whatever the machine. Actions or motions involving the most hazardous exposures may be clarified as:

Rotating, Reciprocating, and Transverse Motions
In-Running Nip Points
Cutting Actions
Punching, Shearing, and Bending Actions

A discussion of these actions or motions, along with typical illustrations of each, follows.

ROTATING, RECIPROCATING, AND TRANSVERSE MOTIONS

Rotating, reciprocating, and transverse motions create hazards in two general areas--at the point-of-operation where work is being done, and at the points where power or motion is being transmitted from one part of a mechanical linkage to another. Since guarding at the point-of-operation will be discussed under the classifications of action or motion, this section will be devoted primarily to situations where power is being transmitted or the point-of-operation is not clearly defined (extractors, mixers, etc.).

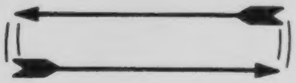
Any rotating object is dangerous. Even smooth, slowly-rotating shafts can grip clothing or hair, and through mere skin contact force an arm or hand into a dangerous position. Accidents due to contact with rotating objects are not frequent, but the severity of injury is always high.

Collars, couplings, cams, clutches, flywheels, shaft ends, spindles, rotating bar stock, lead screws, and horizontal or vertical shafting are typical examples of common rotating mechanisms which are hazardous. The danger increases when bolts, oil cups, nicks, abrasions, and projecting keys or screw threads are exposed when rotating.

ROTATING

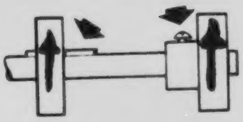
In many cases, the rotating mechanism is located within a stationary case or shell and consists of a revolving cylinder, a screw, agitator blades, or paddles. Washing machines, extractors, raw material mixers, and screw conveyors are typical examples of this type of hazardous rotating mechanism.

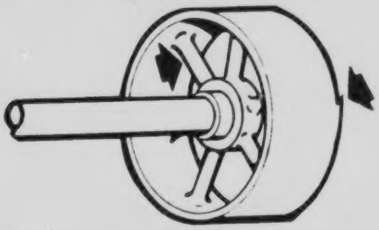
TRANSVERSE
(in straight line)


RECIPROCATING

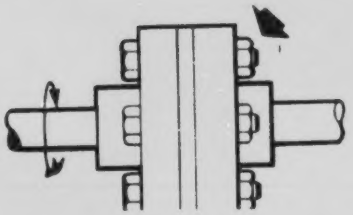
Reciprocating and transverse motions are hazardous because, in the back and forth or straight line action, a worker may be struck or caught in a pinch or shear point between a fixed or other moving object.

EXAMPLES OF TYPICAL ROTATING, RECIPROCATING, AND TRANSVERSE MECHANISMS

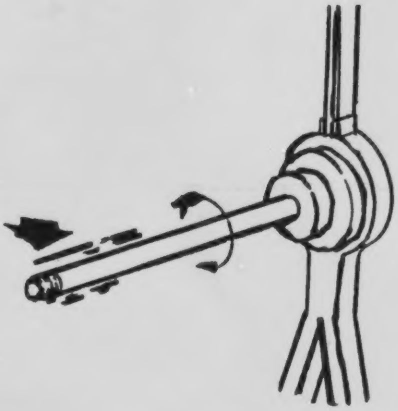

ROTATING SHAFT AND PULLEYS WITH PROJECTING KEY AND SET SCREW


ROTATING PULLEY WITH SPOKES AND PROJECTING BURR ON THE FACE OF THE PULLEY

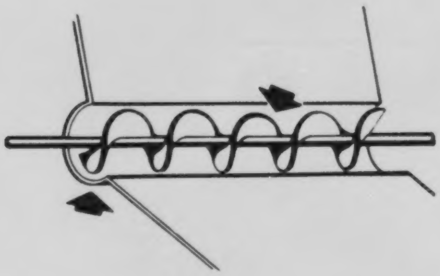
EXAMPLES OF TYPICAL ROTATING, RECIPROCATING, AND TRANSVERSE MECHANISMS (CONTINUED)



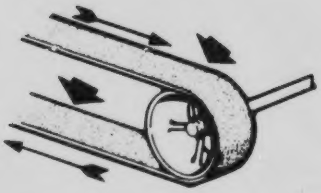
ROTATING PULLEY WITH SPOKES AND PROJECTING BURR ON THE FACE OF THE THE PULLEY



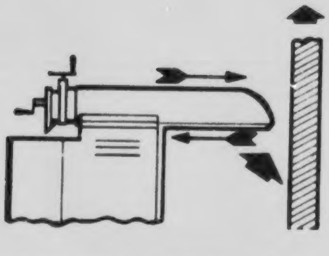
ROTATING BAR STOCK AT THE END OF THE SCREW MACHINE



ROTATING SCREW CONVEYOR



TRANSVERSE MOTION OF BELT AND ROTATING PULLEY

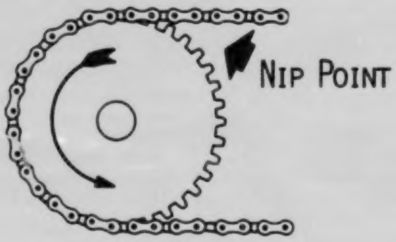


RECIPROCATING ACTION OF MACHINE CREATING A PINCH POINT AT THE FIXED OBJECT

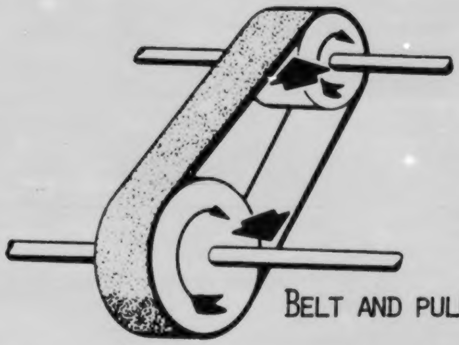
In-Running Nip Points

In-running nip points are a special danger, existing only through the action of rotating objects. Whenever machine parts rotate toward each other, or where one rotates toward a stationary object, an in-running nip point is formed. Objects or parts of the body may be drawn into this nip point and be bruised or crushed.

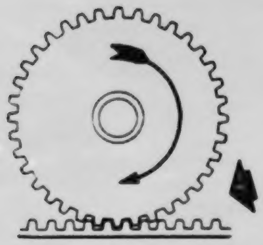
The in-running side of rolling mills and calenders; or rolls used for bending, printing, corrugating, embossing, or feeding and conveying stock; the in-running side of a chain and sprocket belt and pulley, a gear rack, a gear and pinion, and a belt conveyor terminal are typical examples of nip point hazards.



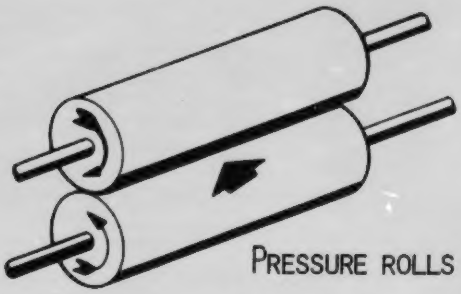
CHAIN AND SPROCKET



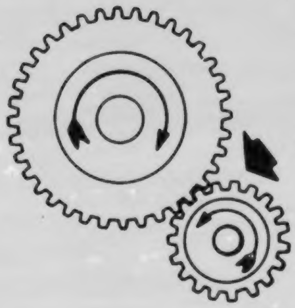
BELT AND PULLEY



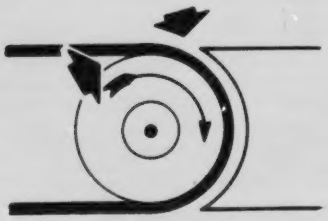
RACK AND GEAR



PRESSURE ROLLS



GEAR TRAIN

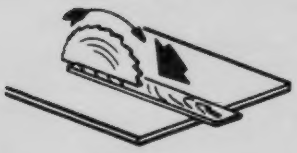


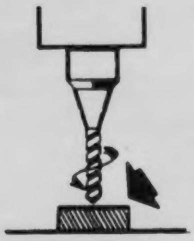
CONVEYOR TERMINAL

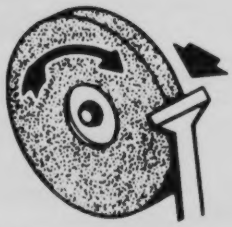
CUTTING ACTIONS

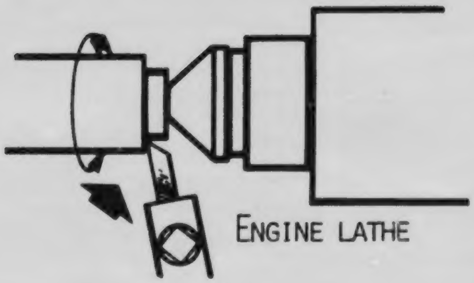
A cutting action results when rotating, reciprocating, or transverse motion is imparted to a tool so that the material being removed is in the form of chips. The danger of cutting action exists at the movable cutting edge of the machine as it approaches or comes in contact with the material being cut. Such action takes place at the point-of-direction in cutting wood, metal, or other materials, as differentiated from punching, shearing, or bending by press action.

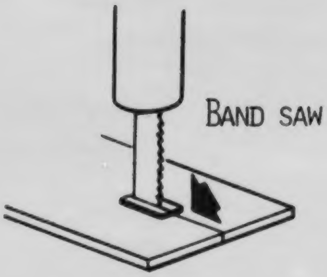
Typical examples of mechanisms involving cutting action include: band and circular saws, milling machines, planing or shaping machines, turning machines, boring, drilling machines, and grinding machines.

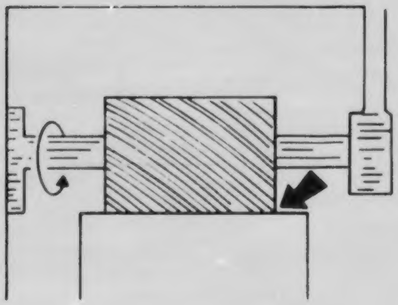

CIRCULAR SAW

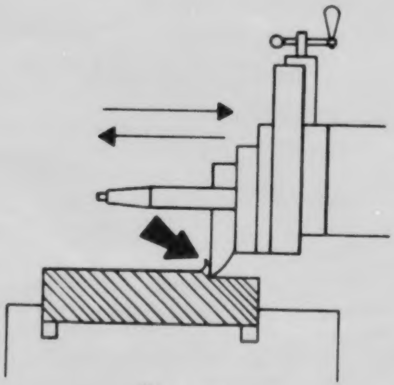

DRILL


ABRASIVE WHEEL


ENGINE LATHE


BAND SAW

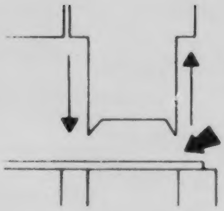

MILLING MACHINE


SHAPER

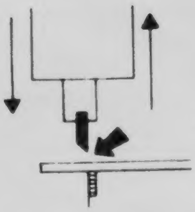
PUNCHING, SHEARING, AND BENDING ACTIONS

A punching, shearing, or bending action results when power is applied to a ram (plunger) or knife for the purpose of blanking, trimming, drawing, punching, shearing, or stamping metal or other materials, as differentiated from removing the material in the form of chips. The danger of this type of action lies at the point-of-operation where stock is usually inserted, maintained, and withdrawn.

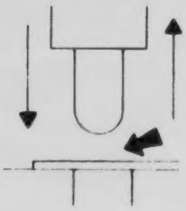
Typical examples of equipment involving punching, shearing, or bending action include: power presses, foot and hand presses, bending presses or brakes, as well as squaring, guillotine, and alligator sheers.



PUNCHING



SHEARING



BENDING

METHODS OF GUARDING ACTIONS AND MOTIONS

Whenever hazardous machine actions or motions are used, a means for providing protection for the operator and fellow workers is essential. There may be several ways to guard a situation, particularly at the point-of-operation.

This does not mean that certain guarding methods are not preferable to others, but the type of operation, the size or shape of the stock, the method of handling, the physical layout, the type of material, and production requirements or limitations may present important considerations. A certain flexibility in operations may also determine the practicability of the method to be used.

As a general rule, power transmission apparatus can be protected by fixed enclosure guards. It is when guarding the point-of-operation, where work is being done on an object, that the most effective and practical of several means of guarding must be selected.

CLASSIFICATION OF GUARDS

The methods of guarding may be grouped under four main classifications:

1. ENCLOSURE GUARDS
    a. Fixed enclosures
    b. Adjustable enclosures
2. INTERLOCKING GUARDS
    a. Enclosure or gate guard with electrical or mechanical interlock
    b. Barrier with electrical or mechanical interlock activating a brake
    c. Electronic or other type field or beam connected with operating and stopping mechanism
3. AUTOMATIC GUARDS
    a. Moving barrier connected to operating mechanism of machine (push-away)
    b. Removal device connected to operator, and operating mechanism of machine (pull-away)
    c. Limitation of stroke
    d. Automatic pressure release devices
4. REMOTE CONTROL, PLACEMENT, FEEDING, EJECTING
    a. Two-hand tripping devices (also multiple operation)
    b. Automatic or semi-automatic feed
    c. Special jigs or holding devices
    d. Special handtools and dies
    e. Special ejecting devices

ENCLOSURE GUARDS

Fixed enclosure guards shall be used in preference to all other types. They prevent access to dangerous parts at all times by completely enclosing the hazardous operation. They are also used to restrain bursting machine parts. They admit the stock, but will not admit the hands into the danger zone because of a limited feed-opening size. They may be constructed so as to be adjustable to different sets of tools or dies, but once adjusted they shall remain fixed.

Enclosure guards shall be installed at the point where a cutting, bending, punching, or shearing action takes place on the material being processed, and at other places where there may be a hazard caused by inserting or manipulating stock. They shall also be used to prevent contact with the rotating, reciprocating, and transverse motion of the machine members away from the point-of-operation.

METHODS OF GUARDING ACTIONS AND MOTIONS--ENCLOSURE GUARDS

GUARDING METHODS	GUARD ACTIONS	LIMITATIONS
Fixed Enclosure--	Barrier or enclosure which admits the stock but which will not admit hands into danger zone because of feed opening size, remote location, or unusual shape. Also used to completely enclose power transmission apparatus. Used to contain bursting machine parts.	Limited to specific operations. May require special tools to remove jammed stock. May interfere with visibility. Require interlocks for repair or maintenance work.
Adjustable Enclosure--	Barrier or enclosure which is adjusted to fit around different sizes or shapes of the die. When adjusted, provides same protection as fixed enclosure.	Often requires frequent adjustment and careful maintenance.

INTERLOCKING GUARDS

When a fixed enclosure guard is not practicable, an interlocking enclosure or barrier should be considered as the first alternative.

An interlocking enclosure guard is not fixed and may be opened or removed as the operation requires. However, due to an electrical or mechanical interlocking connection with the operating mechanism, the operation of the machine is prevented until the guard is returned to an operating position, and the operator can no longer reach the point of danger.

An interlocking enclosure guard should do three things:

1. Shut off or disengage the power to prevent the starting of the machine when the guard is open.
2. Guard the danger point before the machine can be operated.
3. Keep the guard closed until the dangerous part is at rest, or stop the machine when the guard is opened.

When gate guards or hinged enclosure guards are used with interlocks, they should be designed so they will completely enclose the point-of-operation before the operating clutch can be engaged.

An interlocking barrier guard quickly stops the machine, or prevents the application of injurious pressure, when any part of the operator's body contacts the barrier. The barrier may be a bar, a rod, a wire, or some similar device (not an enclosure), extended across the danger zone and interlocked electrically or mechanically with a braking mechanism. Electrical interlocking devices should be so designed that if they fail, they fail safe; thus making the guard machine inoperative.

Another type of interlocking barrier may be in the form of an electric-eye beam, a magnetic, radioactive, or similar type circuit so designed and installed that when the operator's hand or any part of the body is in the danger zone, the machine cannot be operated. Or, if the hand or any part of the body is inserted while the machine is in motion, the interlocking barrier guard will immediately activate a braking mechanism.

METHODS OF GUARDING ACTIONS AND MOTIONS--INTERLOCKING GUARDS

GUARDING METHODS	GUARD ACTIONS	LIMITATIONS
Enclosure with electrical or mechanical interlock	Enclosure or barrier shuts off or disengages power and prevents starting of machine when guard is open; prevents opening of the guard while machine is under power or coasting. (Interlocks should not prevent manual operation or "inching" by remote control.)	Requires careful adjustment and maintenance. Operator may be able to make guard inoperative. Does not protect in event of mechanical repeat.
Barrier with electric contact or mechanical stop activating mechanical or electrical brake	Barrier quickly stops machine or prevents application of injurious pressure when any part of the operator's body contacts it or approaches danger zone.	Requires careful adjustment and maintenance. Possibility of minor injury before guard operates. Operator can make guard inoperative.
Electric-eye	Electric-eye beam and brake quickly stop machine or prevents its starting if the hands are in the danger zone.	Expensive to install. Does not protect against mechanical repeat. Generally limited to use on slow speed machines with friction clutches or other means to stop the machine during the operating cycle.

AUTOMATIC GUARDS

When neither an enclosure guard nor an interlocking guard is practicable, an automatic guard may be used. This guard acts independently of the operator, repeating its cycle as long as the machine is in motion. This type of guard removes the operator's hands, arms, or body from the danger zone as the ram, plunger, or other tool closes on the piece upon which work is being done. It is operated by the machine itself through a system of linkages connected to the operating mechanism.

The common types of automatic guards are the sweep and push-away devices. These are moving barriers which cross the danger zone when the machine is activated, and pull-away devices consisting of hand and arm attachments which pull the operator away from the danger zone. Sweep and push-away devices shall be designed to prevent the operator from reaching behind or across the protective device, thus taking him/her into the danger zone before the machine has completed its closing cycle. The device itself must not offer a hazard by creating a shear point between the moving guard and a stationary or moving part of the machine. An automatic pressure release or pivoting arm device will provide utility, yet will protect in-running nip point situations.

METHODS OF GUARDING ACTIONS AND MOTIONS--AUTOMATIC GUARDS

GUARDING METHODS	GUARD ACTIONS	LIMITATIONS
Push-away device with barrier	A movable barrier, attached to the pressure part, which pushes or lifts the hands out of danger zone.	Hands must be in normal position for guard to be effective. Hands may be caught by guard. Possible interference with the feeding stock. Slow action may decrease production. Does not permit blanking.
Pull-away device	A cable operated attachment on the ram, connected to the operator's hands or arms to pull the hands back, but only if they remain in the danger zone. Otherwise, it does not interfere with normal operation.	Requires unusually good maintenance, adjustment to each operator, and frequent inspection necessary. Limits the movement of operator. May obstruct workspace around the operator. Does not permit blanking from hand-fed strip stock from side of press.
Limitation of stroke	Plunger travel limited to 3/8 inch or less; fingers cannot enter between pressure points.	Small opening limits size of stock.

REMOTE CONTROL, PLACEMENT, FEEDING, EJECTING

Although they are not guards in the technical sense, there are certain methods which can be used to accomplish the same effect; that is, the protection of the operator from the hazardous point-of-operation. They may be used to complement one of the other types of guards or may be used in lieu of guards.

Two-handed operating devices may be used to activate a machine. These devices require the simultaneous action of the operator's two hands on electrical switch buttons, air control valves, or mechanical levers. On presses with a noninterrupting stroke, two-handed operating devices shall require manual operation until a point in the cycle is reached at which the hazard ceases. Hand controls may be interconnected with foot controls to permit operation of the machine. The actuating controls shall be so located as to make it impossible for the operator to move his hands from the controls to the danger zone before the machine has completed its closing cycle. The two-handed controls shall be so designed as to prevent the blocking, tying down, or holding down of one control in order to allow one hand free access to the point-of-operation. When more than one person is working on a machine, additional controls must be installed and designed so that all persons will simultaneously activate the starting mechanism from remote locations.

Automatic or semi-automatic feeding mechanisms (roll, plunger, chute, slide, dial feeds, and revolving dies) may be used in conjunction with ram enclosures. Special, soft-metal hand tools may be used to place or remove parts in conjunction with an enclosure, interlocking, or automatic guard. Special jigs, holding devices, and dies may be used to manipulate the stock at the point-of-operation, yet will still keep the hands safe. Mechanical or air-operated ejecting mechanisms may be used to remove parts, thus eliminating the need for the hands to be placed in the danger zone.

The theory behind these methods is that if, for any reason, it is impossible to completely enclose or isolate the hazard, the next best device or combination of devices shall be used to keep the exposure to a minimum.

METHODS OF GUARDING ACTIONS AND MOTIONS--
REMOTE CONTROL, PLACEMENT, FEEDING, EJECTING

GUARDING METHODS	GUARD ACTIONS	LIMITATIONS
Two-hand trip (can be adapted to multiple operation)	Simultaneous pressure of two hands on switch buttons in a series actuates machine Simultaneous pressure of two hands on air control valves, mechanical levers, controls, interlocked with foot controls, or the removal of solid blocks or stops permits normal operation of the machine.	Operator may try to reach into danger zone after tripping machine. Does not protect against mechanical repeat unless blocks or stops are used. Some trips can be rendered unsafe by holding with the arm or by blocking or tying down one control, thereby permitting one-hand operation. Cannot be used for some blanking operations.
Special jigs or feeding devices	Hand-operated feeding devices of metal or wood which keep the operator's hands at a safe distance from the danger point.	Machine itself is not guarded; safe operation depends upon the correct use of device. Requires good pupil training and close supervision. Suitable for limited types of work.
Special tools or handles on dies	Long-handled tongs, vacuum lifters, or hand die holders which avoid need for the operator putting hand in danger zone.	Operator must keep hands out of danger zone. Requires unusually good training and close supervision.
Special ejecting devices	Air or mechanical ejection.	Limited size of stock used in conjunction with other guarding methods.

THE TECHNIQUES OF MECHANICAL GUARDING

It is recognized that a given situation--a hazard-creating motion--may frequently be guarded in a number of ways; several of which may be satisfactory. The selection of the guarding method to be used may depend upon a number of things--space limitations, production methods, size of stock, frequency of use, and other factors which may be important in making the final decision. It is not the intent of this unit to suggest which method of guarding is the best for a given situation, but rather to show that there are a number of ways in which to guard each different condition. This will be done by illustrative typical situations which may be guarded by a variety of methods.

In the illustrations, the various motions and actions are shown with typical guards illustrating the various guarding techniques. It is not possible to apply all of the guarding techniques to all of the motions or actions, but an effort has been made to show those that are frequently found in industry.

GUARDING ROTATING, RECIPROCATING, OR TRANSVERSE MOTIONS

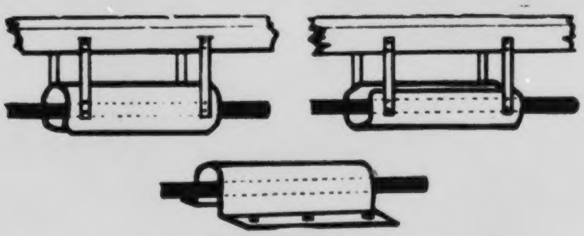
Rotating, reciprocating, and transverse motions are forms or directions of motions that are used for a variety of purposes. They may be used to transmit power. For example: a revolving shaft or pulley (rotating), a moving piston (reciprocating), or a moving belt (transverse). Motions are also used to perform work by giving action to a tool or die which executes a cutting or shearing action. Thus, a circular saw or milling cutter (rotating), a metal planer or shaper (reciprocating), or a band saw (transverse) are examples of using motion to perform useful work by means of a tool.

Motion is also used as a means of performing work without the cutting action of tools. A centrifugal extractor or dough mixer (rotating), a shaker screen (reciprocating), or a belt or screw conveyor (transverse) are examples of using the energy of motion to perform useful work.

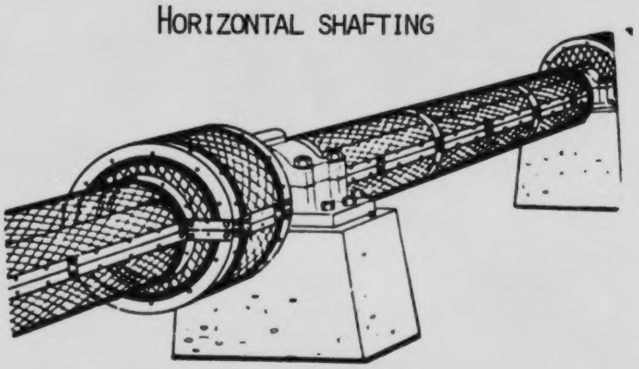
The illustrations on the next pages are intended to show the recognized techniques for guarding the various forms of motion used for transmitting power and for performing work without the benefit of tools.

Where tools are used to perform useful work, a cutting, punching, bending, or shearing action is involved. Techniques of guarding these various actions will be illustrated under the general heading of the type of action, instead of under the heading of the type of motion used to drive or power the tool.

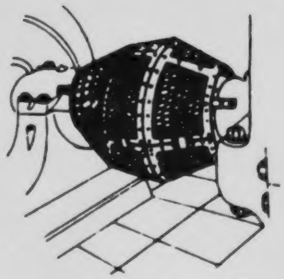
GUARDING ROTATING MOTION BY ENCLOSURE GUARDS



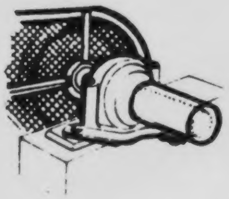
HORIZONTAL SHAFTING



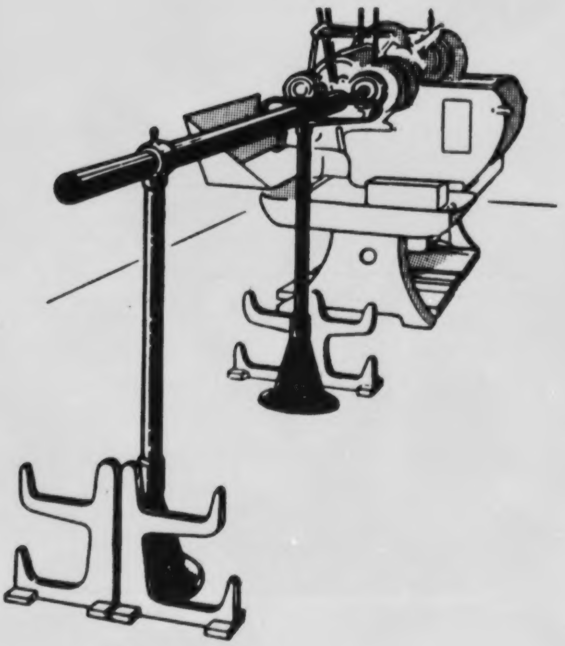
HORIZONTAL SHAFTING



COUPLING



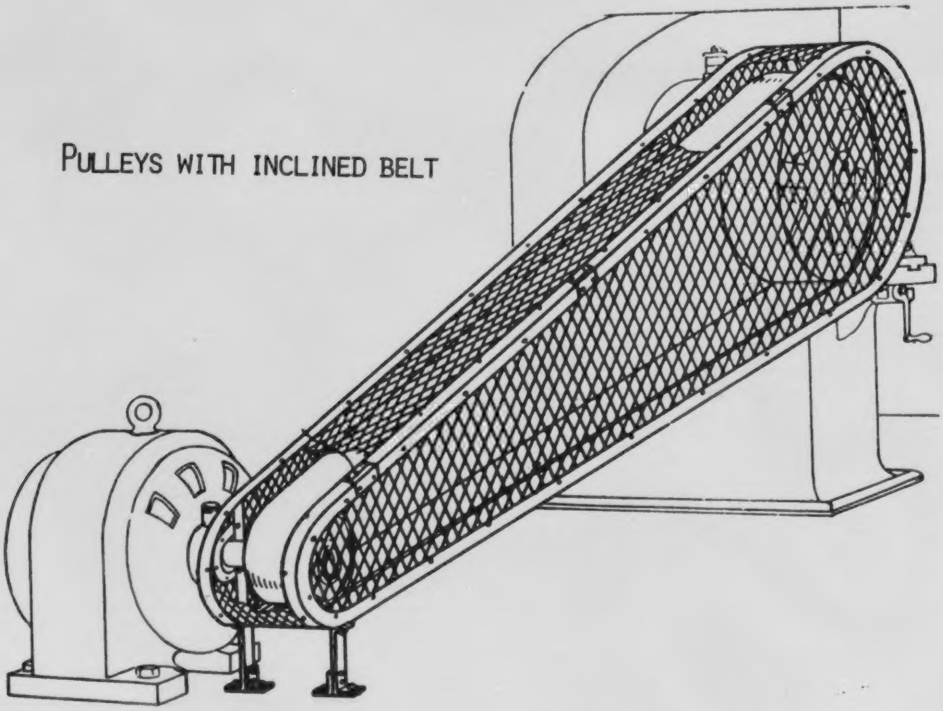
SLEEVE FOR SHAFT END



REVOLVING BAR STOCK GUARD

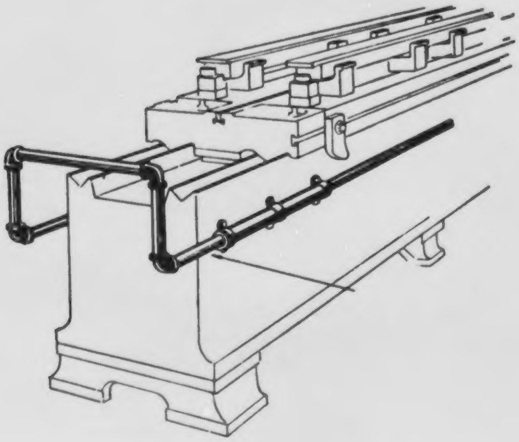
Automatic screw machines must be equipped with guards, known as "stock tubes," which enclose the rotating bar stock. It is important that the bar stock fits completely inside the stock tube so that the rotating ends are not exposed.

GUARDING ROTATING AND TRANSVERSE MOTIONS BY ENCLOSURE GUARDS



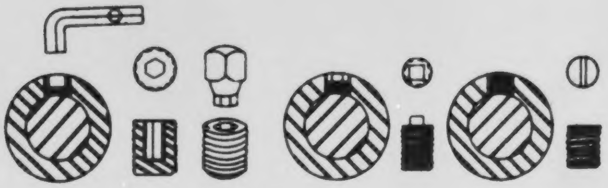
PULLEYS WITH INCLINED BELT

GUARDING RECIPROCATING MOTION OF MACHINE PARTS BY BARRIER GUARD

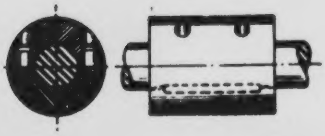


PLANER TABLE GUARD

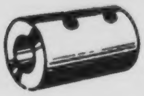
ELIMINATION OF ROTATING MOTION HAZARD BY MEANS OTHER THAN GUARDING



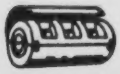
SAFETY SET SCREWS



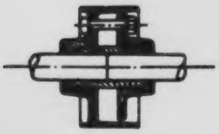
SPLIT COUPLING



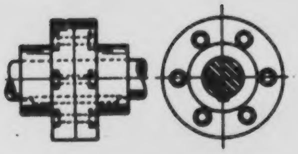
SOLID SLEEVE COUPLING



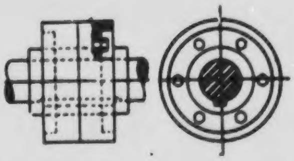
CLAMP COUPLING WITH SAFETY SLEEVES



COMPRESSION TYPE COUPLING



BOLT HEADS AND NUTS COUNTERSUNK



FLANGES PROJECT BEYOND BOLT HEADS AND NUTS

SAFETY SHAFT COUPLINGS

GUARDING IN-RUNNING NIP POINTS

In-running nip points may exist under two broad classes of conditions, namely:

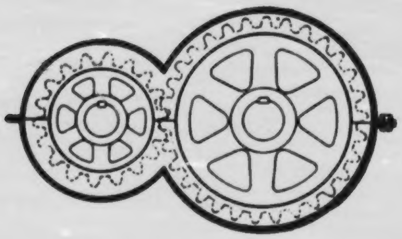
1. Those purposely created to do useful work.
2. Those which are incidental to the transmission of power or the application of motion; the nip point itself doing no useful work.

Nip points that are purposely created to do useful work would include situations such as calender rolls used for finishing paper, rolls used for mixing ink or rubber, and rolling mills used for reducing the thickness of or changing the shape of metals.

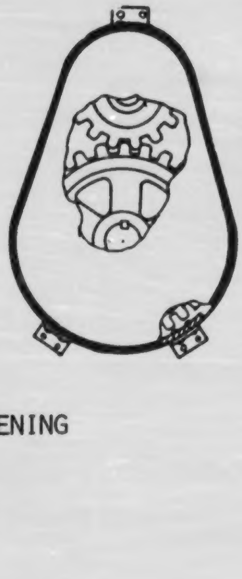
Nip points created incidental to the transmission of power would include the nip point of a belt and pulley, the meshing of gears, or the take-off point of a belt conveyor. Nip points created incidental to the application of motion would include the nip or pinch point of the moving bed of a metal planer with the frame of the machine or an adjacent fixed object.

In any case, guarding is necessary, and various means may be used to provide protection. The following illustrations show typical nip point situations and the techniques for guarding them.

GUARDING IN-RUNNING NIP POINTS BY ENCLOSURE GUARDS

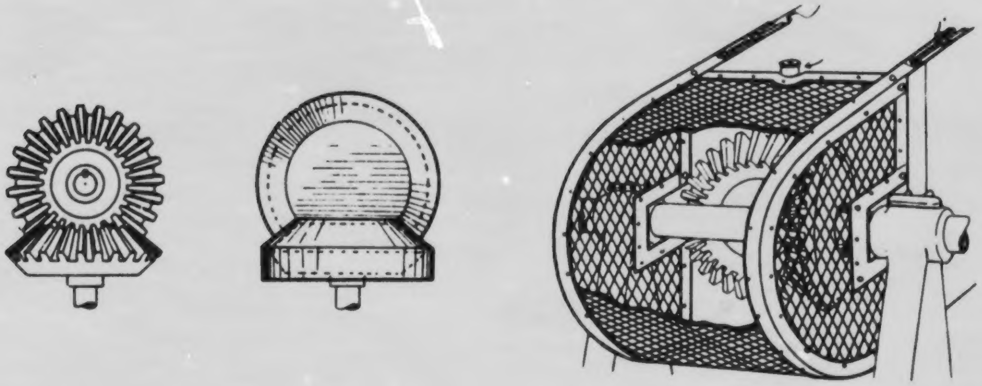


SPUR GEAR GUARDS

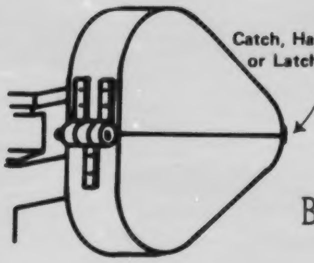


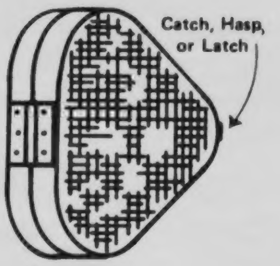
TOTALLY ENCLOSED GUARD
SPLIT AND HINGED FOR EITHER TOP OR SIDE OPENING

GUARDING IN-RUNNING NIP POINTS BY ENCLOSURE GUARDS



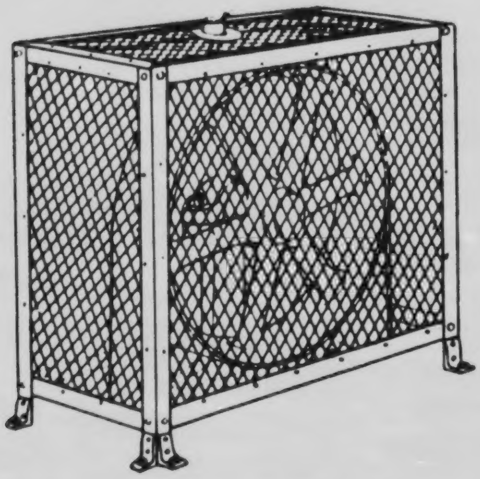
BEVEL GEAR GUARDS

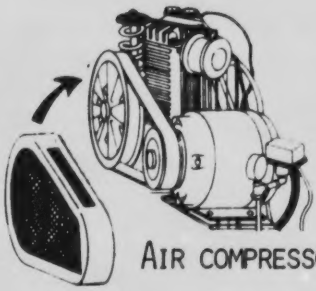

Catch, Hasp or Latch


Catch, Hasp, or Latch

BELT AND PULLEY GUARDS

GUARDING IN-RUNNING NIP POINTS BY ENCLOSURE GUARDS

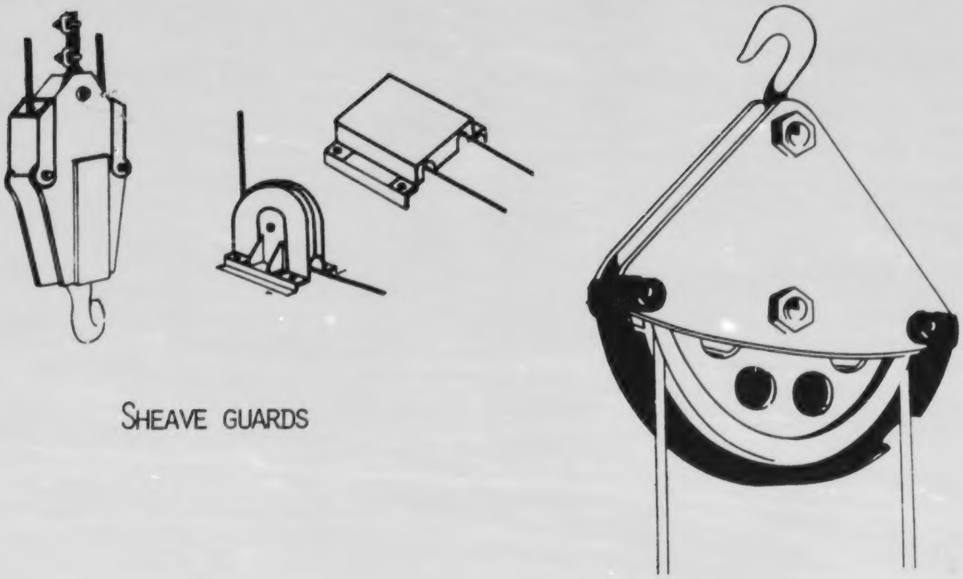




AIR COMPRESSOR

The pulleys and drive belts of air compressors must be fully enclosed.

BELT AND PULLEY GUARDS



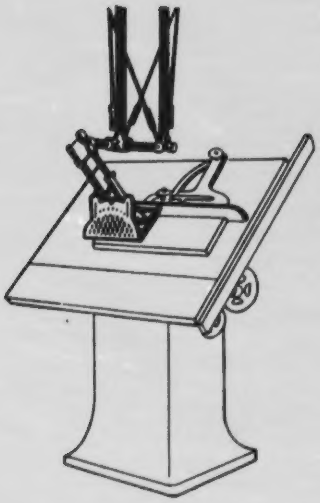
SHEAVE GUARDS

GUARDING CUTTING ACTIONS

Cutting action is involved in the whole range of machine tools used for cutting metal. Also, it is involved in the machines used for working on wood. The characteristic of a machine tool is that the metal removed is in the form of chips. This characteristic also applies to machines used for cutting wood, although woodworking machines are not referred to as machine tools. Many machines used in the food, plastic, paper, or textile industries (as well as in other industries) also employ cutting action. The hazard lies at the point where the cutting takes place.

Various forms of motion may be involved in the cutting action, but the kind of motion is not the determining factor in selecting the best guarding method. In many cases, a choice of guarding methods is available. The following illustrations show the various methods of guarding typical cutting actions.

GUARDING CUTTING ACTIONS BY ENCLOSURE GUARDS



TILTING TABLE SAW GUARD

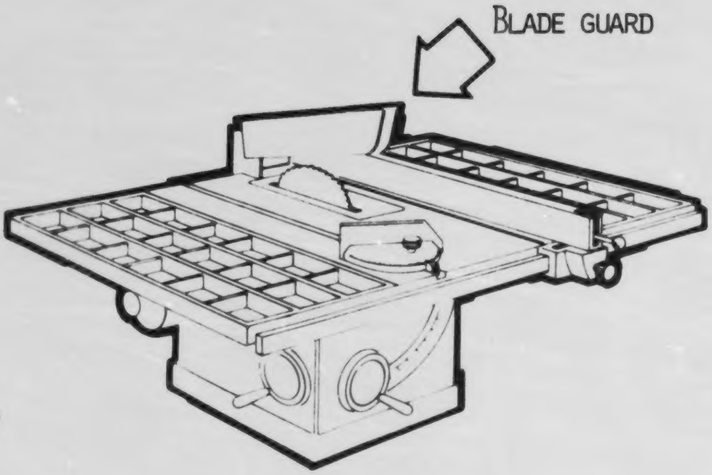
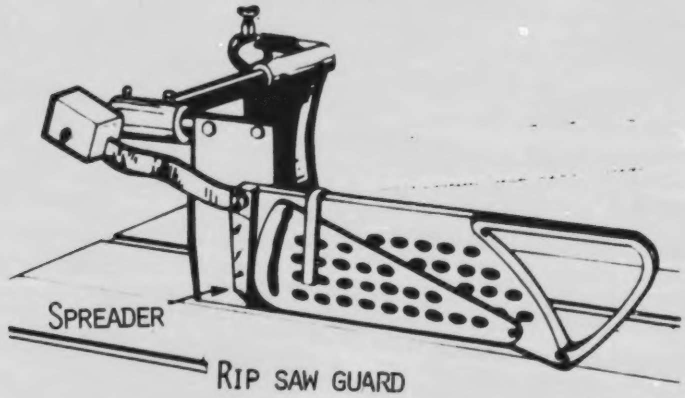


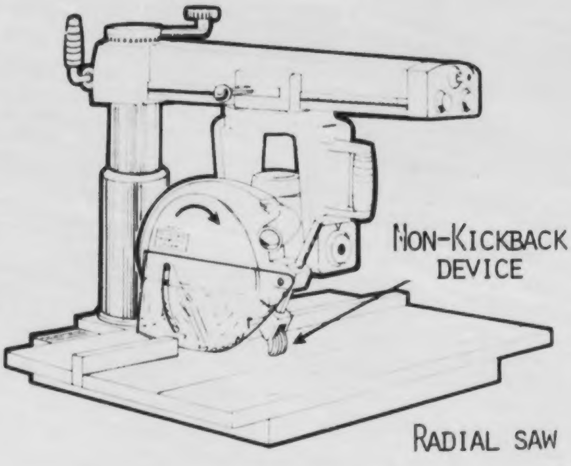
TABLE SAW

GUARDING CUTTING ACTIONS BY ENCLOSURE GUARDS



Circular saws shall be provided with a hood that covers the saw, at all times, to the depth of the teeth. The hood should adjust itself automatically to the thickness of, and remain in contact with, the material being cut. A spreader and anti-kickback device should be provided. The exposed part of the saw underneath the table should be guarded.

RADIAL SAW-In addition to the hood enclosing the blade, an adjustable stop shall be provided to limit forward travel. The head should automatically return to the starting position. When used for ripping, a spreader and anti-kickback device should be provided.



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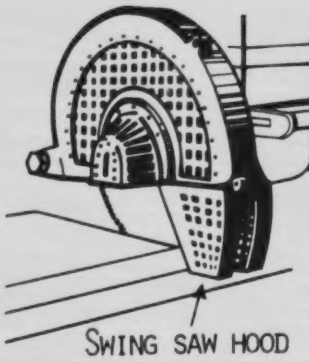
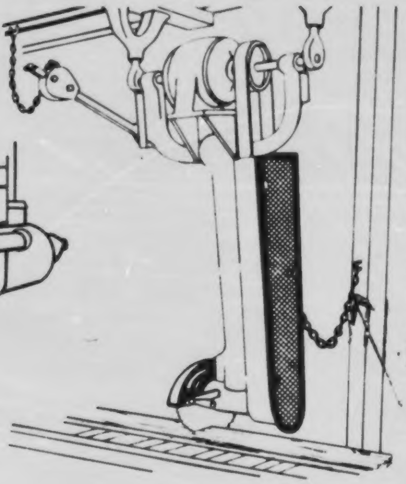
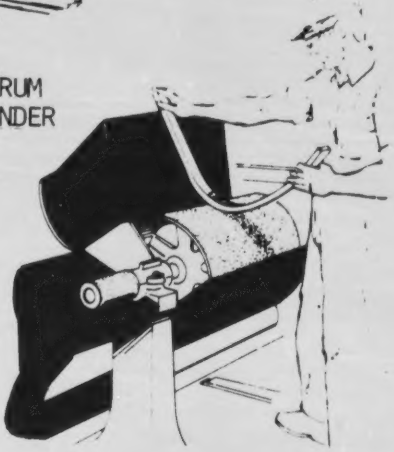
GUARDING CUTTING ACTIONS BY ENCLOSURE GUARDS

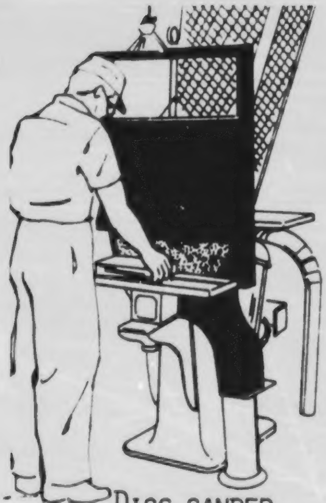
SWING SAW-In addition to the hood enclosing the blade, the swing saw MUST be provided with a limit chain or other device to limit forward travel. It must also have a device which will automatically return the head to the starting position. The hood MUST enclose the saw.


SWING SAW HOOD

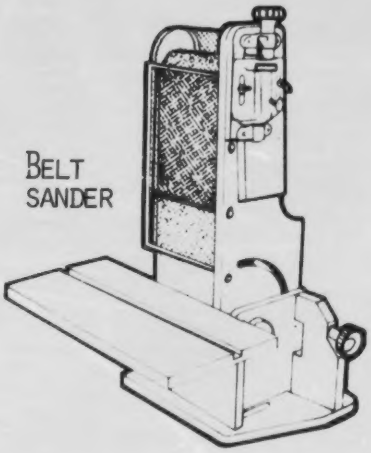

LIMIT CHAIN

DRUM SANDER



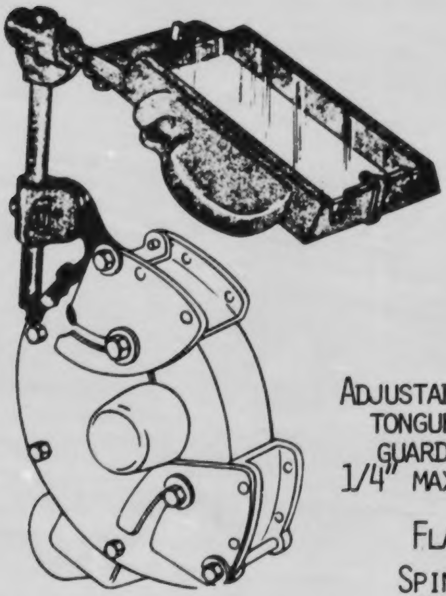

DISC SANDER

BELT SANDER

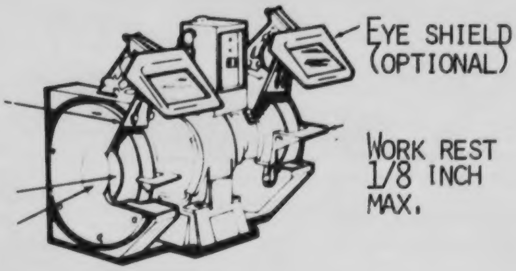


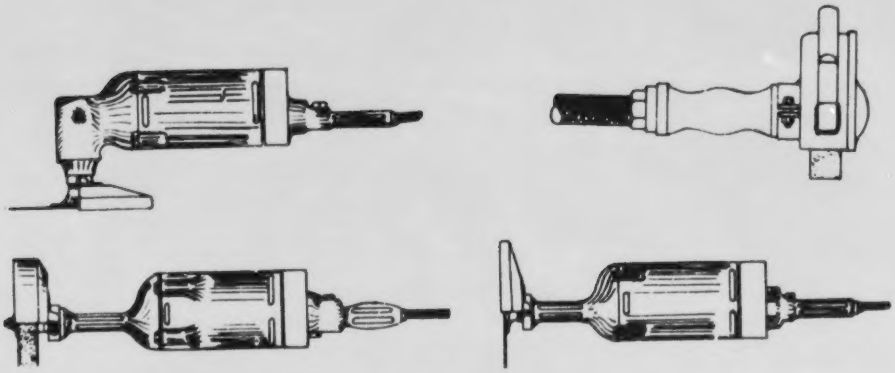
SANDERS- Exposed parts of disc, drum, or roll feed sanders MUST be guarded, except for that portion where the material comes in contact with the abrasive. Feed rolls in front of the sander MUST also be guarded. The guards serve as dust collectors.

GUARDING CUTTING ACTIONS BY ENCLOSURE GUARDS



ABRASIVE WHEEL GUARD-The guard should be strong enough to withstand the shock of a bursting wheel and be adjustable to the wear of the wheel. Tempered or laminated glass, with protective glass on the underside, should be used. Work rests should be kept adjusted close to the wheel, with a maximum distance of 1/8 inch.

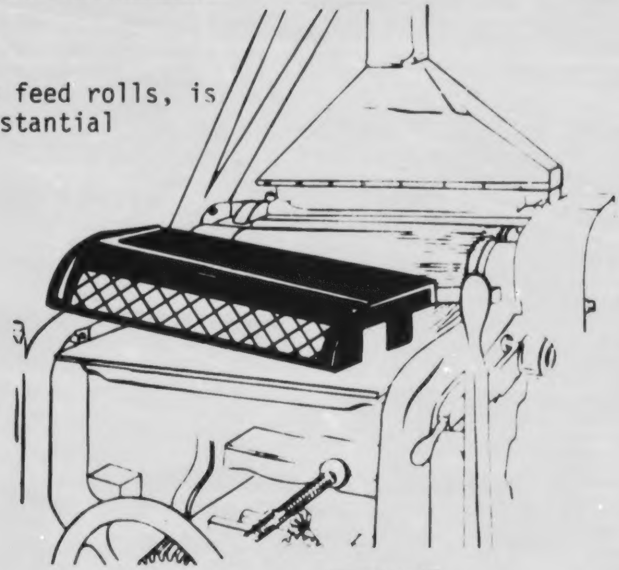

ADJUSTABLE TONGUE GUARD 1/4" MAX
FLANGE
SPINDLE GUARD
EYE SHIELD (OPTIONAL)
WORK REST 1/8 INCH MAX.

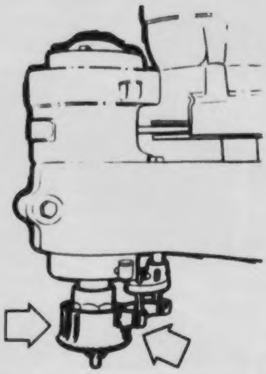


PORTABLE ABRASIVE WHEEL-It should also be guarded by as complete an enclosure as practical.

GUARDING CUTTING ACTIONS BY ENCLOSURE GUARDS

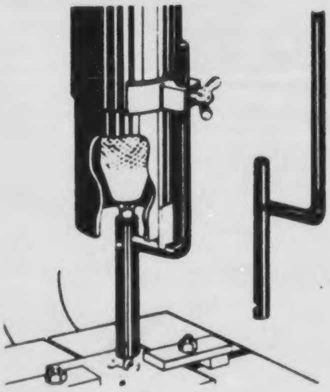
PLANER-The guard for the feed rolls, is removed, showing its substantial construction.

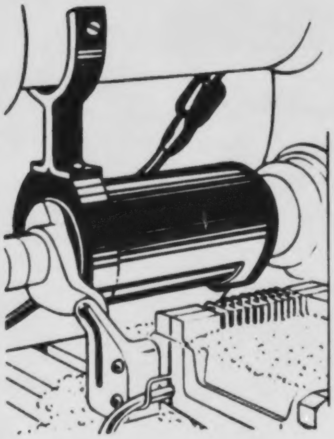




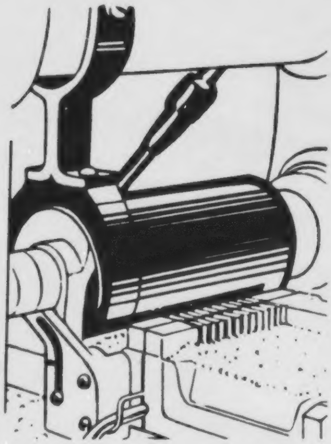
ROUTER-The enclosure covers the top and sides of the router.

DRILL-The enclosure covers the spindle and drill.



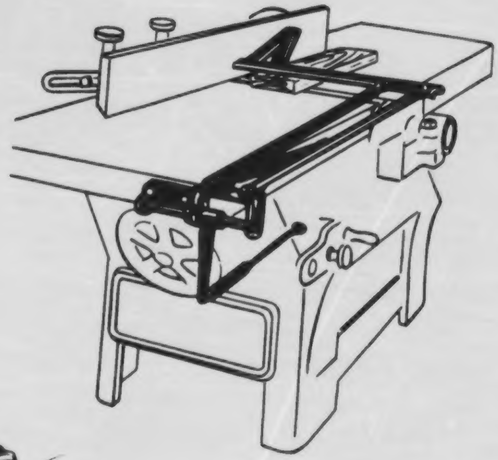


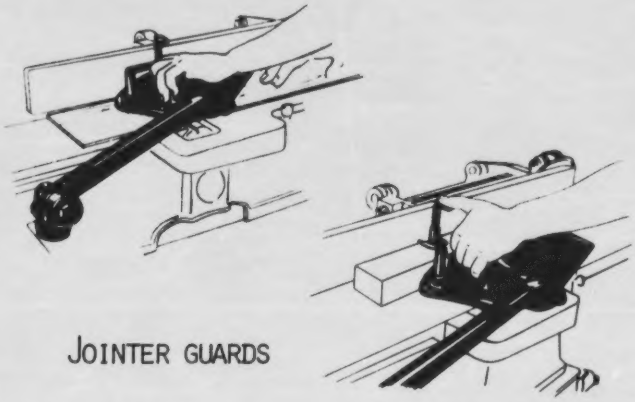
MILLING MACHINES-The cutter is entirely enclosed when the table is withdrawn, and the guard opens automatically as the table moves forward.



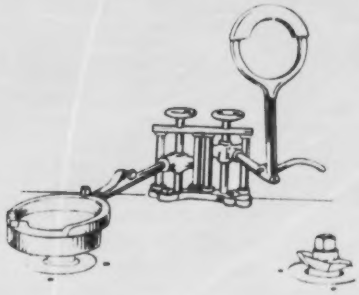
GUARDING CUTTING ACTIONS BY BARRIER GUARDS

JOINTER guards MUST automatically adjust themselves to cover all sections of the head on the working side of the fence or gauge and shall remain in contact with the material at all times. The section of the cutting head back of the fence or gauge MUST also be guarded.

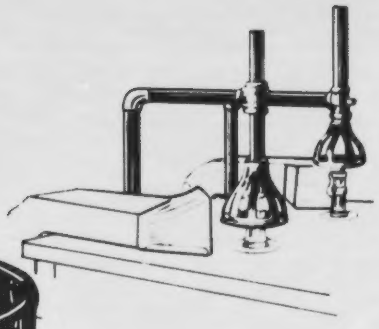


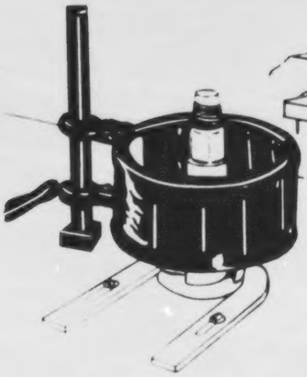


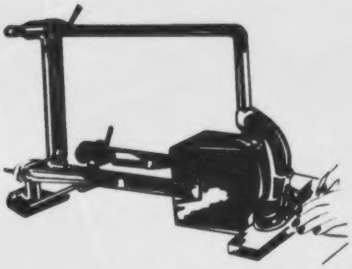
JOINTER GUARDS



SHAPER GUARDS



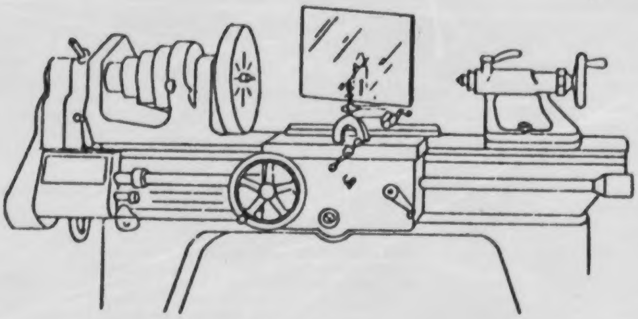




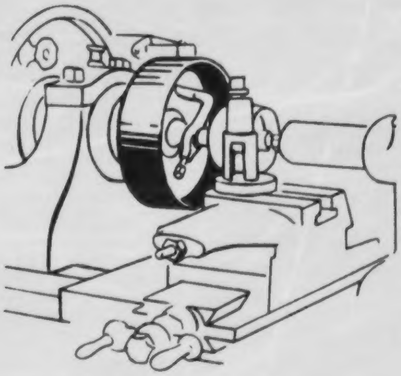
The cutting head of each wood shaper MUST be enclosed by an adjustable guard so designed as to keep the operator's hand away from the cutting edge. Patterns for jigs used for holding stock while shaping are also desirable.

Guarding Cutting Actions by Barrier Guards

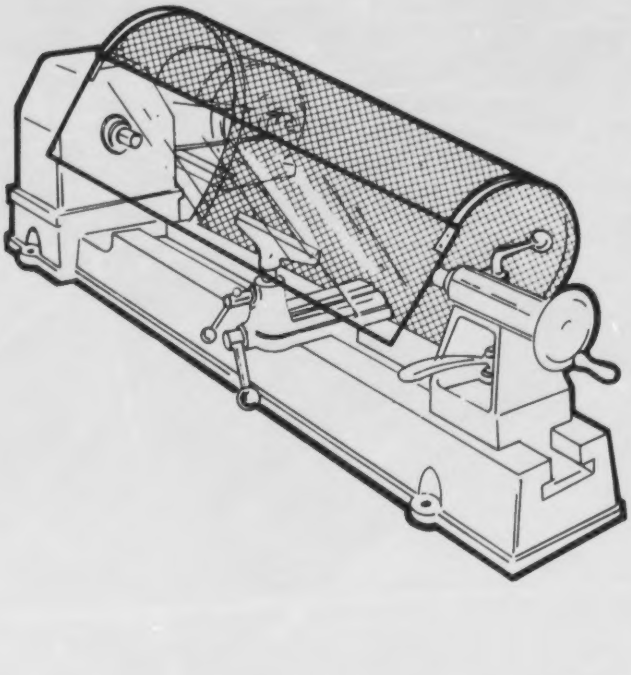
LATHES

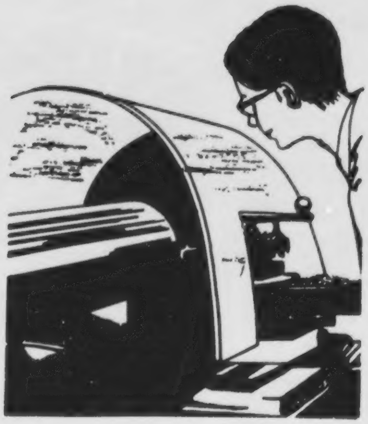


A clear plastic shield held in place by a magnet will protect against flying particles.



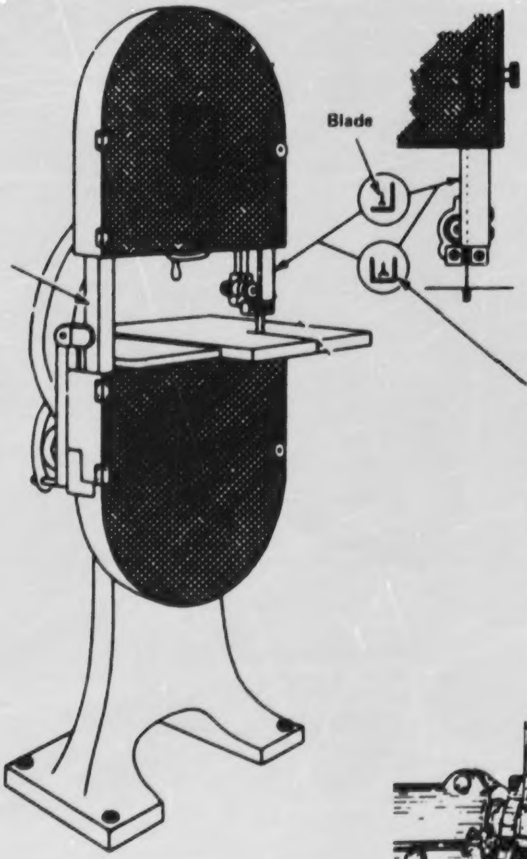
A metal band around the face plate prevents contact with the lathe dog.





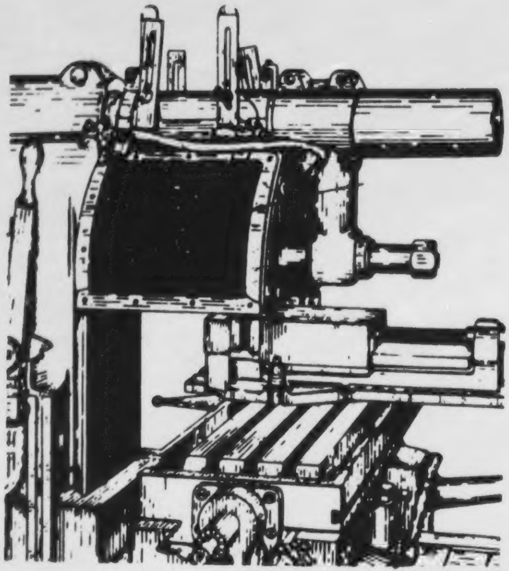
LATHE-A transparent guard encloses the point-of-operation.

GUARDING CUTTING ACTIONS BY BARRIER GUARDS



GUARD-Illustration shows front and sides with box and angle.

BANDSAW-Band of bank resaw wheels must be completely enclosed, and all portions of the blade must be guarded (except for that portion between the guide rolls and the table).



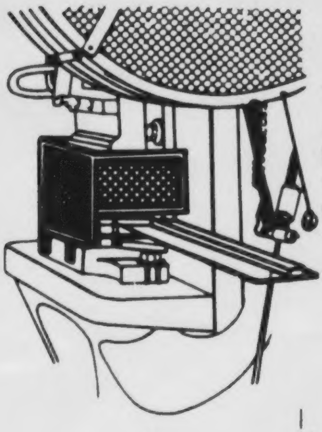
MILLING MACHINE-The mesh guard over the cutter is designed to protect against accidental contact and also to contain chips.

GUARDING PUNCHING, BENDING, AND SHEARING ACTIONS

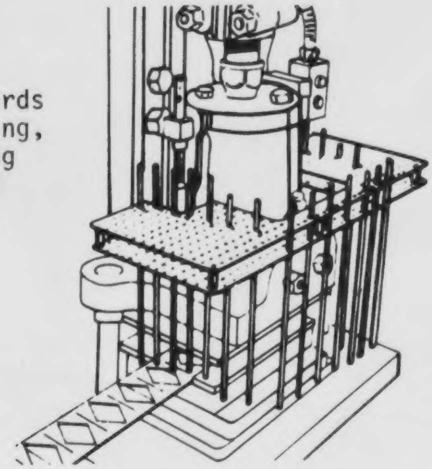
Punching, bending, and shearing actions differ from cutting actions in that material is not removed in the form of chips. This class of action is used primarily to form or shape metals, but may be used on materials other than metal; for example: plastics, fabrics, and papers. These actions are particularly hazardous with respect to the severity of any injury inflicted. Many such injuries result in amputation or other permanent disability. As in the case of cutting actions, the hazard is at the point-of-operation.

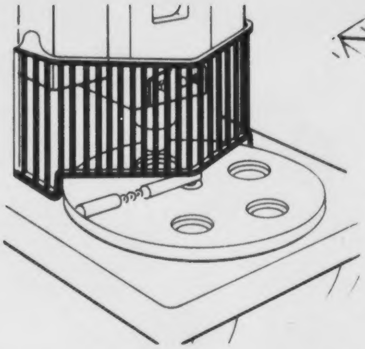
The following are illustrations of machines which perform punching, bending, or shearing actions and techniques by which they are guarded.

GUARDING PUNCHING OR BENDING ACTIONS BY ENCLOSURE GUARDS



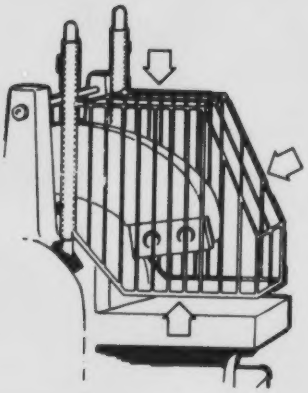
These enclosure guards are used for notching, punching, or forming presses, to be used with strip feeding.



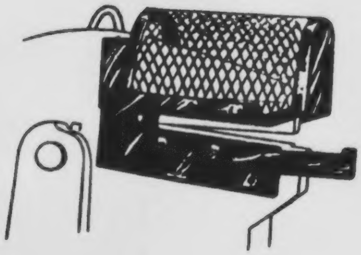


These are enclosure guards for punching or forming presses to be used with dial feeding.

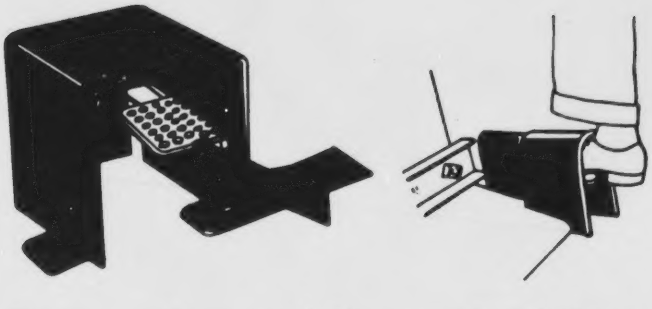
GUARDING SHEARING ACTION BY ENCLOSURE GUARDS



ALLIGATOR SHEARS

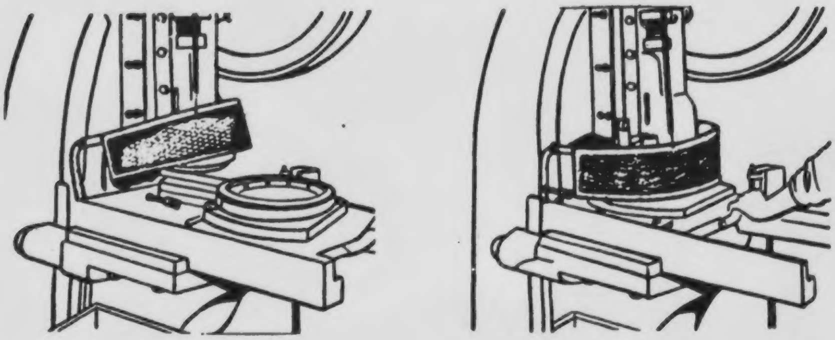


ENCLOSURE GUARDS FOR ALLIGATOR SHEARS



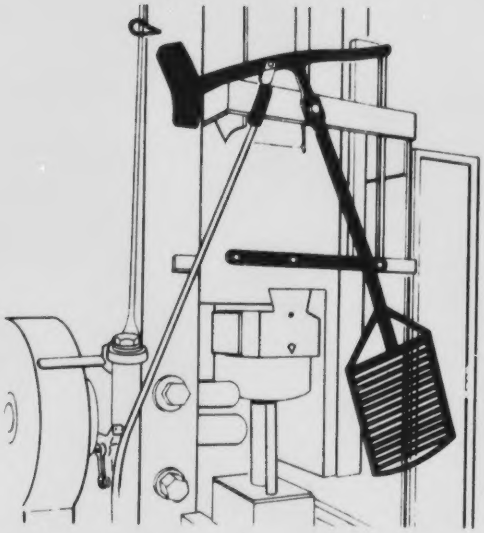
TREADLE GUARDS-These guards are used for presses and shears to prevent unintentional tripping.

GUARDING PUNCHING OR BENDING ACTIONS BY BARRIER GUARDS



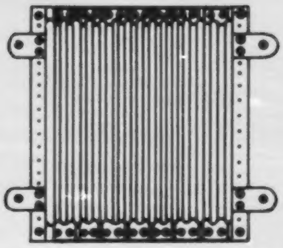
Stock is fed into the die outside the danger zone. A hinged barrier guard closes automatically when the sliding die is moved into position.

PUNCH PRESS

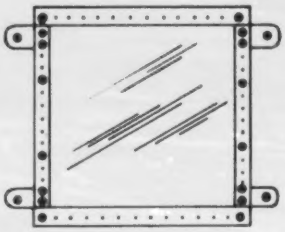


A barrier guard, operated by the tripping device of the press, is interposed in front of the plunger before the plunger descends.

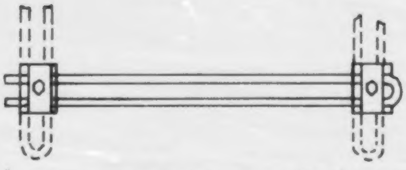
DIFFERENT STYLES OF BARRIER GUARDS



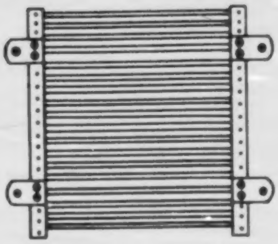
PERMASITE, HINGED or RIGID- Tension piano wire is stretched on a channel frame. It's best for visibility into the die area because it is non-reflective and is not affected by oil film or scratches providing 93% visibility.



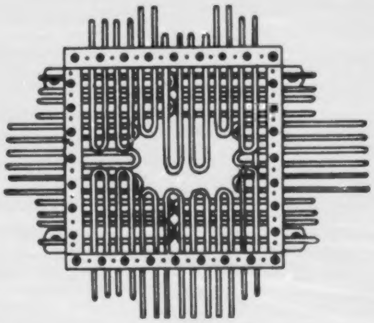
LEXAN, HINGED or RIGID- Lexan inserts are used for visibility and to contain shrapnel from material, broken punches, or die parts if this is a problem.



LADDER ROD ASSEMBLY- Each assembly consists of one horizontal hairpin and clamps to attach it to the vertical hairpins. They are made of steel, and the material may be fed over or through them.

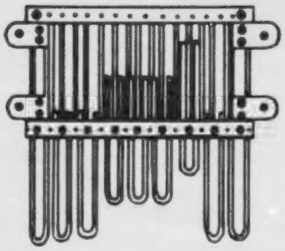


LADDER, RIGID or HINGED- This is a horizontal rod insert for feeding a strip of coil stock so that the material enters and a skeleton exists between them. The rods are stressproof steel.

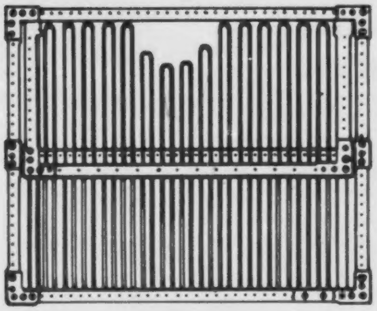


4-WAY RIGID- A 4-way insert has hairpins that adjust from all four sides. This allows it to close the openings all around the material being fed. It is ideal for feeding formed, channel type material.

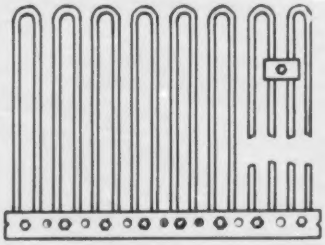
DIFFERENT STYLES OF BARRIER GUARDS



ADJUSTABLE INSERT-This insert is usually installed on the side panels so that the steel hairpins can be adjusted closely around the stock guides and feeds. If the hairpins are adjusted up in order to clear something, and an area underneath becomes exposed, refer to the ladder rod assembly on the preceding page for additional guarding.

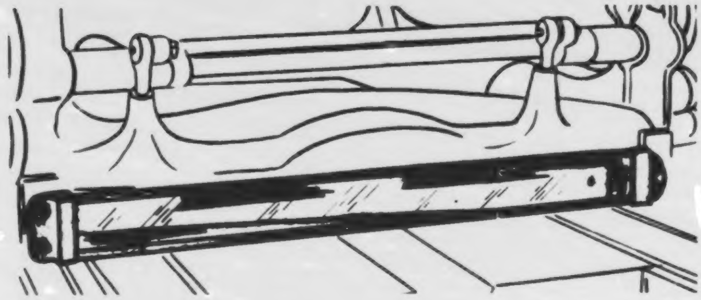


ADJUSTABLE LIFE GATE-This gate can be furnished in most any width of the panel. Steel hairpins are used and are individually adjustable. The gate also slides up as a unit for access to the die without changing the hairpin adjustment.

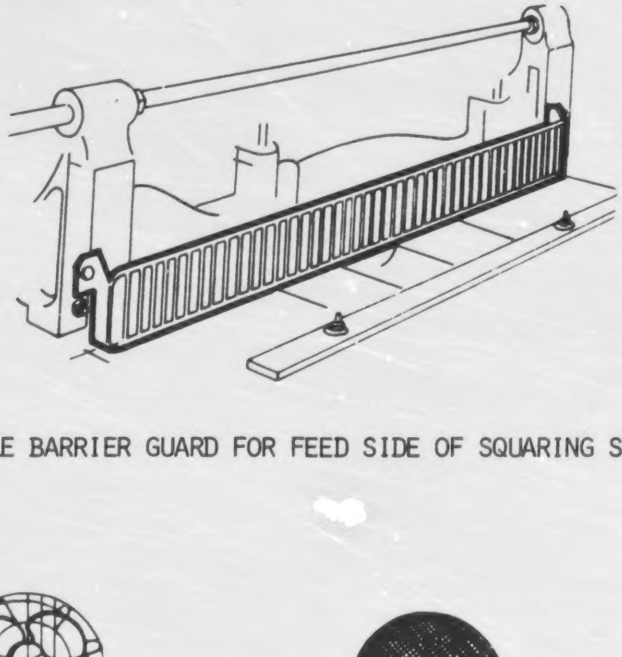


ROOF SECTION and SIDE SHIELDS-The roof sections are used with box, inclinable, gap, post or bar-constructed channel panel. The roof is used so that a person cannot reach over the guard into the die area. The side shields are used with the spring lift guards to protect the sides.

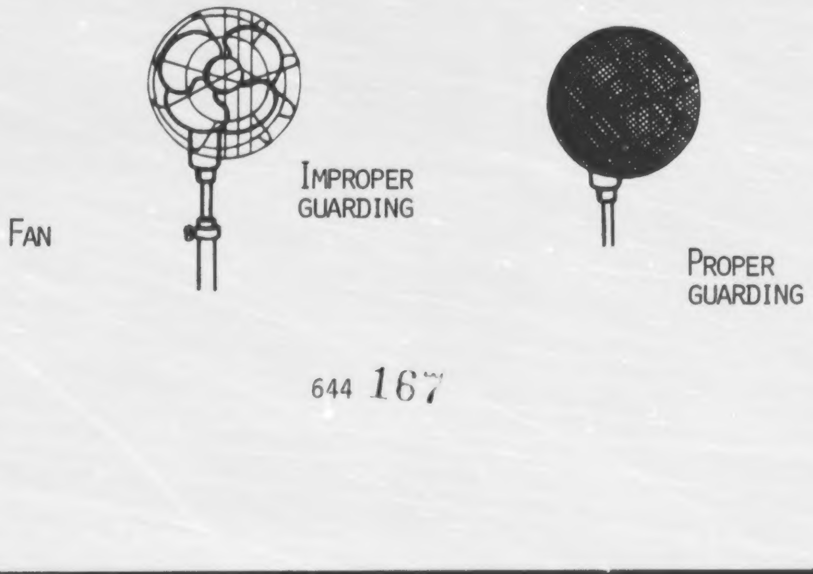
GUARDING SHEARING ACTION BY BARRIER GUARDS



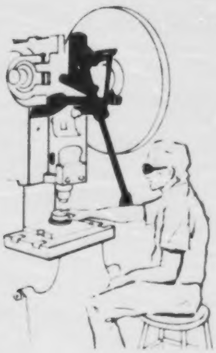
FIXED TRANSPARENT BARRIER GUARD FOR SHEAR



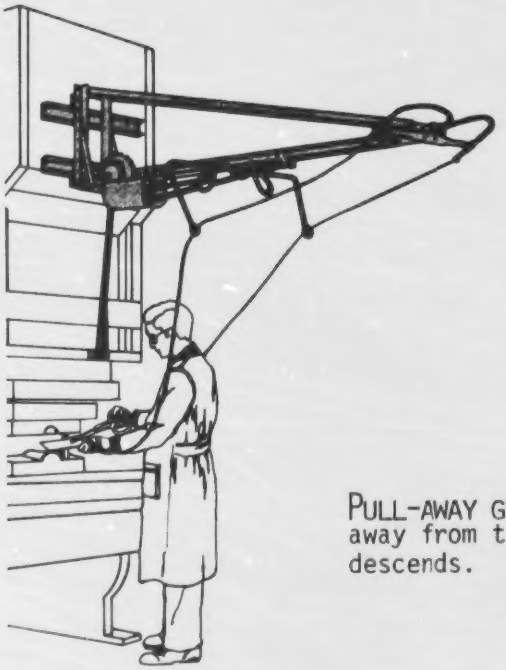
ADJUSTABLE BARRIER GUARD FOR FEED SIDE OF SQUARING SHEAR

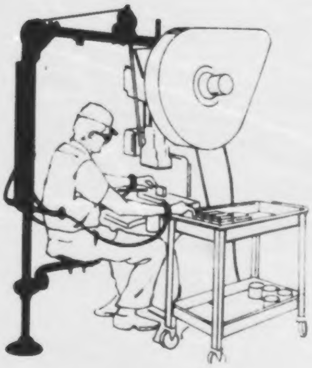

FAN
IMPROPER GUARDING
PROPER GUARDING

GUARDING PUNCHING OR BENDING ACTIONS BY AUTOMATIC GUARDS



PUSH-AWAY GUARD-The sweep guard pushes the operator's hand away from the danger zone before the ram descends. Double sweep arms are preferable, and barrier guards at the sides of the die are desirable in order to prevent the operator from reaching around it.

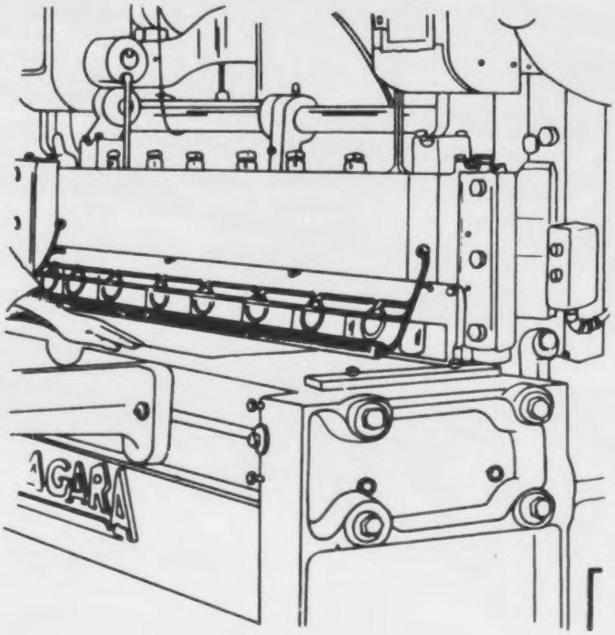




PULL-AWAY GUARD-The operator's hands are pulled away from the danger zone before the ram descends.

GUARDING PUNCH PRESSES BY AUTOMATIC PUSH-AWAY OR PULL-AWAY GUARDS

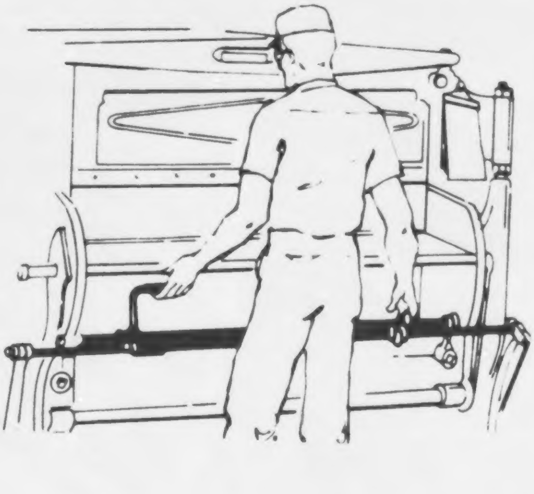
GUARDING SHEARING ACTION BY AUTOMATIC GUARDS



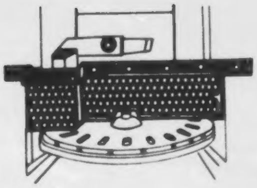
POWER SHEARS - The roller guard rests on the sheet stock as it is fed into the shear. The descending ram will force the roller out, and it will push the operator's hands away from the knife. When the ram ascends, the roller will rest in a vertical position.

GUARDING SHEARING ACTION BY REMOTE CONTROL PLACEMENT, FEEDING, OR EJECTION

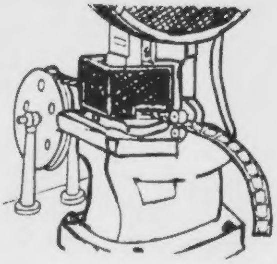
PAPER GUILLOTINE SHEAR - This is a two-handed tripping device.



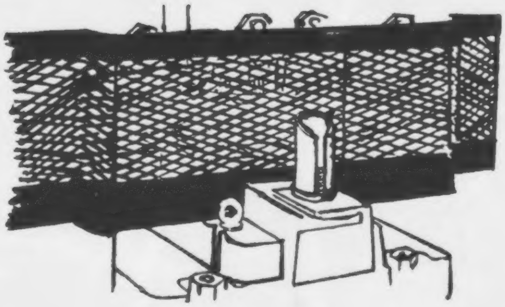
GUARDING SHEARING ACTION BY REMOTE CONTROL, FEEDING OR EJECTION



ROTATING DIE - The stock is fed manually into the rotating die and is carried automatically under the plunger.

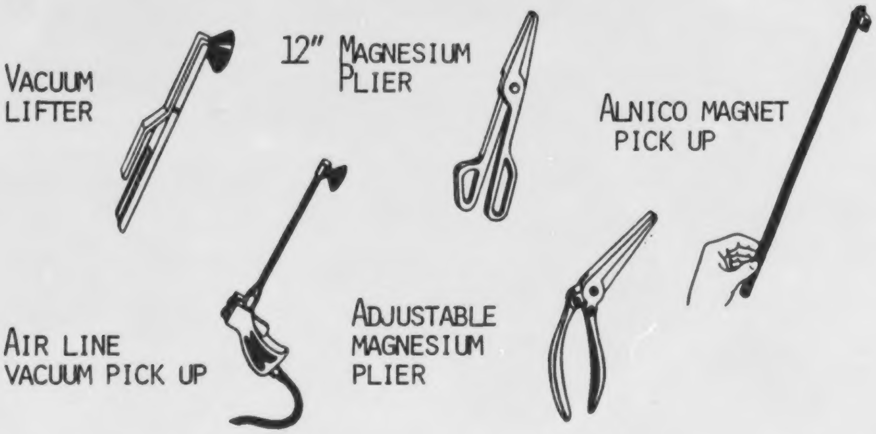


AUTOMATIC FEED - The stock is fed automatically to the plunger. The operator is required only to restock the feeding device.

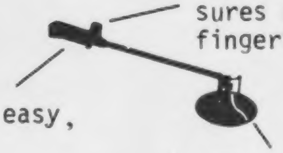


Other types of enclosure guards for use with automatic feeding are illustrated here.

GUARDING PUNCHING ACTION BY REMOTE CONTROL, FEEDING, OR EJECTION


VACUUM LIFTER
12" MAGNESIUM PLIER
ALNICO MAGNET PICK UP
AIR LINE VACUUM PICK UP
ADJUSTABLE MAGNESIUM PLIER

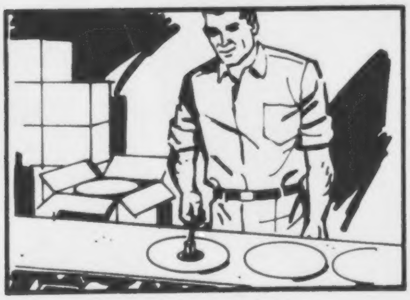
GUARDING BY THE USE OF SPECIAL TOOLS - The use of specially designed hand tools for placing material into the press is also acceptable.

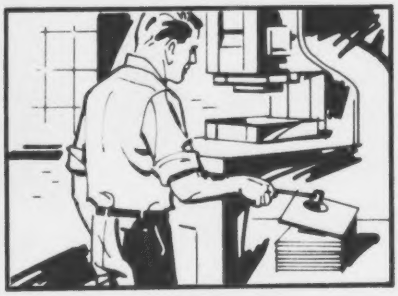


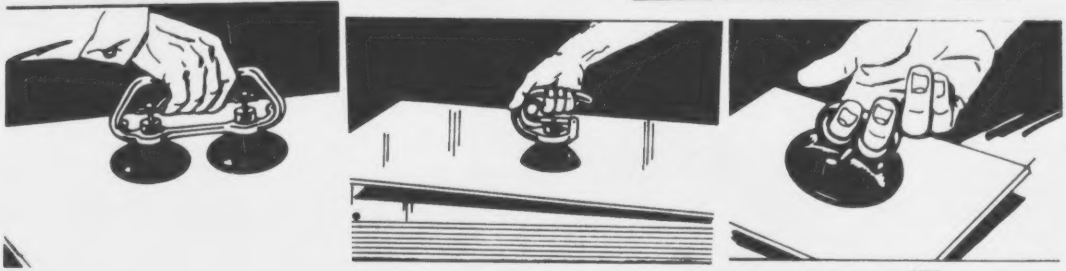
A precision valve mechanism assures a positive release with fingertip push-botton control.

The pistol grip assures easy, sure holding.

The vacuum cup picks up work.

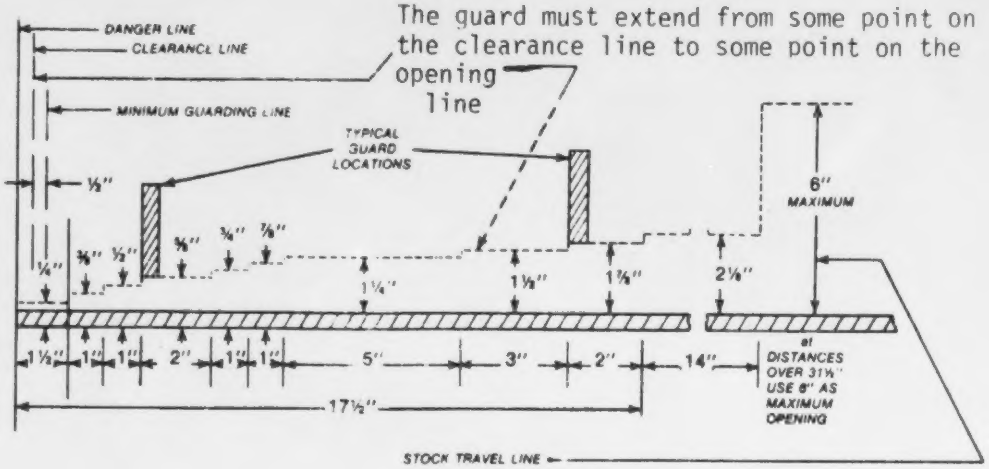






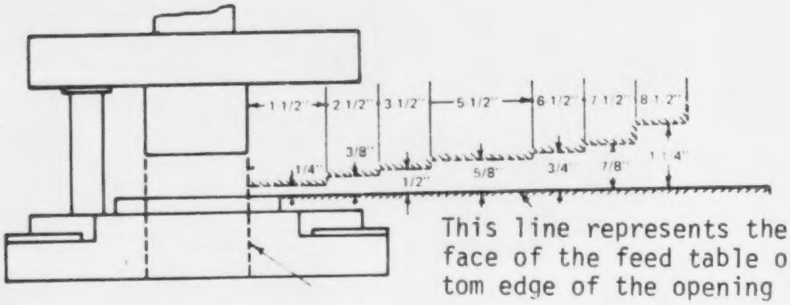
GUARDING PUNCHING ACTION BY REMOTE CONTROL, FEEDING, OR EJECTION

MECHANICAL POWER PRESSES
(OSHA)



The guard must extend from some point on the clearance line to some point on the opening line

DANGER LINE
CLEARANCE LINE
MINIMUM GUARDING LINE
TYPICAL GUARD LOCATIONS
½"
¼"
⅜"
½"
⅝"
¾"
⅞"
1¼"
1½"
1⅞"
2⅛"
6" MAXIMUM
1½"
1"
1"
2"
1"
1"
5"
3"
2"
14"
17½"
at DISTANCES OVER 31½" USE 6" AS MAXIMUM OPENING
STOCK TRAVEL LINE



1 1/2"
2 1/2"
3 1/2"
5 1/2"
6 1/2"
7 1/2"
8 1/2"
1/4"
3/8"
1/2"
5/8"
3/4"
7/8"
1 1/4"

This line represents the top surface of the feed table or the bottom edge of the opening in the guard.

Explanation of above diagram:

This diagram shows the accepted safe openings between the bottom edge of a guard and a feed table at various distances from the danger line (point-of-operation).

The clearance line marks the distance required to prevent contact between the guard and moving parts.

The minimum guarding line is the distance between the infeed side of the guard and the danger line.

The various openings are such that for average size hands an operator's fingers won't reach the point-of-operation.

After installation of point-of-operation guards, and before a job is released for operation, a check should be made to verify that the guard will prevent the operator's hands from reaching the point-of-operation.

TABLE 0-10

DISTANCE OF OPENING FROM POINT-OF-OPERATION HAZARD (INCHES)	MAXIMUM WIDTH OF OPENING (INCHES)
1/2 to 1 1/2	1/4
1 1/2 to 2 1/2	3/8
2 1/2 to 3 1/2	1/2
3 1/2 to 5 1/2	5/8
5 1/2 to 6 1/2	3/4
6 1/2 to 7 1/2	7/8
7 1/2 to 12 1/2	1 1/4
12 1/2 to 15 1/2	1 1/2
15 1/2 to 17 1/2	1 7/8
17 1/2 to 31 1/2	2 1/8

This table shows the distances that guards shall be positioned from the danger line in accordance with the required openings.

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GUARD CONSTRUCTION AND SPECIFICATIONS

Machine guards, to be effective, must be built in accordance with recognized standards of construction and performance. They must be designed so as to eliminate the hazard; they must create no hazard of their own; they must be sturdy enough to withstand normal wear; and they should not inferfere with production.

Standards of construction and performance have been developed and refined so that adequate guidelines are now available for anyone purchasing or building guards for most kinds of machines.

SIZE OF FRAMEWORK MATERIALS

1, Minimum dimensions or materials for the framework of all guards (except as noted in paragraph 3) shall be angle iron 1 inch X 1 inch X 1/8 inch, metal pipe of 3/4 inch inside diameter, or metal construction of equivalent strength.

   All guards shall be rigidly braced at every three feet or fractional part of their height to some fixed part of the machinery or building structure. Where the guard is exposed to contact with moving equipment, additional strength may be necessary.

2. The framework for all guards fastened to the floor or working platform, and without other support or bracing, shall consist of 1 1/2 inch X 1 1/2 inch X 1/8 inch angle iron, metal pipe of 1 1/2 inch inside diameter, or metal construction of equivalent strength. All rectangular guards shall have at least four upright frame members, each of which shall be carried to the floor and be securely fastened thereto.

   Cylindrical guards shall have at least three supporting members carried to the floor.

3. Guards of 30 inches or less in height, and with a total surface area not in excess of 10 square feet, may have a framework of 3/8 inch solid rod, 3/4 inch X 3/4 inch X 1/8 inch angle, or metal construction of equivalent strength.

STANDARD MATERIALS FOR GUARDS

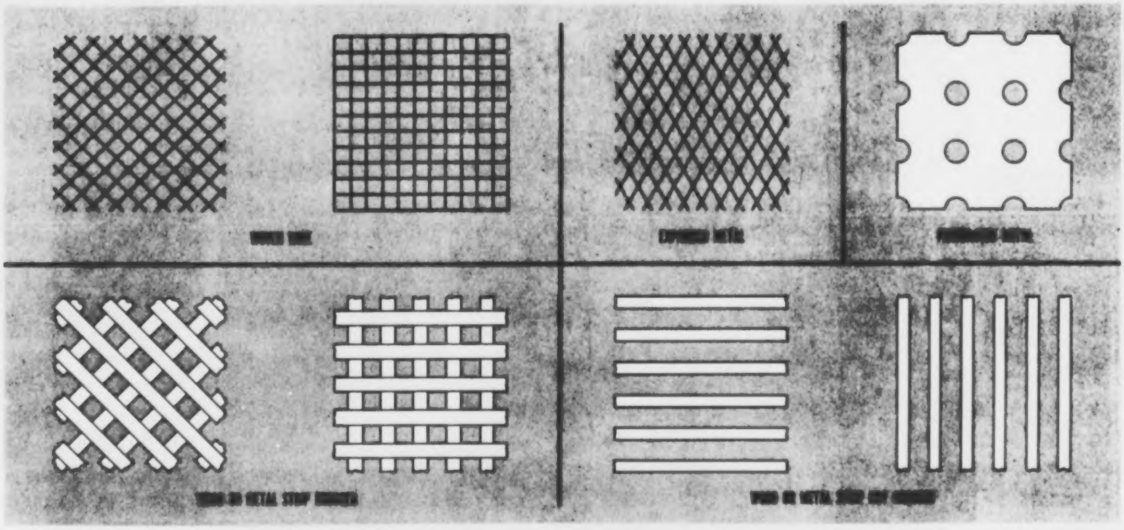


TABLE OF STANDARD MATERIALS AND DIMENSIONS

Material	Clearance from moving part at all points (in inches)	Largest mesh or opening allowable "B" (in inches)	Minimum gage (U.S. standard) or thickness	Minimum height of guard from floor or platform level (in feet)
Woven wire	Under 2 inches	⅜ inch	No. 16	7 feet
	2 inches–4 inches	½ inch	No. 16	7 feet
	Under 4 inches	½ inch	No. 16	7 feet
	4 inches–15 inches	2 inches	No. 12	7 feet
Expanded metal	Under 4 inches	½ inch	No. 18	7 feet
	4 inches–15 inches	2 inches	No. 13	7 feet
Perforated metal	Under 4 inches	½ inch	No. 20	7 feet
	4 inches–15 inches	2 inches	No. 14	7 feet
Sheet metal	Under 4 inches		No. 22	7 feet
	4 inches–15 inches		No. 22	7 feet
Wood or metal strip crossed	Under 4 inches	⅜ inch	Wood ¾ inch or Metal No. 16	7 feet
	4 inches–15 inches	2 inches		
Wood or metal strip not crossed	Under 4 inches	½ inch width		
	4 inches–15 inches	1 inch width		
Standard rail	Minimum 15 inches			3 feet–6 inches
	Maximum 20 inches			3 feet–6 inches

U.S.A. Standard for Mechanical Power-Transmission Apparatus SA B15.1—1953 Reaffirmed 1958

REFERENCES

Materials were selected and reviewed from the following sources and in some instances were incorporated in the production of the preceding unit.

Link Electric & Safety Control Company
Rockford Safety Equipment Company
U.S. Department of Health, Education, & Welfare, National Insititue of Occupational Safety and Health
U.S. Department of Labor, Occupational Safety and Health Administration
General Industry Safety and Health Standards, "Principles and Techniques of Mechanical Guarding"

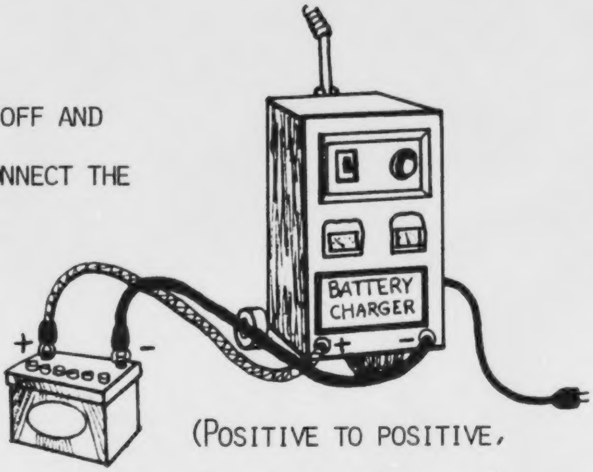
AUTOMOTIVE EQUIPMENT

BATTERY CHARGER

1. Observe eye protection rules. Always use safety glasses when servicing a storage battery.
2. Check the battery electrolyte level before attaching charger cables. Fill only to the recommended level. Do not overfill. Never use a match or lighter to check the electrolyte level. (OSHA)
3. Smoking is prohibited in the charging area. (OSHA)
4. Preplace cell covers during charging. (OSHA)
5. Provide ample ventilation when using a charger. (OSHA)
6. Make sure that the battery charger is turned off and the power cord is unplugged before connecting or disconnecting the charger leads. (Transparency 1).
7. Always connect the charger cables according to the polarity of the battery; negative to negative and positive to positive.
8. Disconnect the battery ground cable before charging.
9. When connecting cables, connect the ground cable last; disconnect the ground cable first.
10. Follow the manufacturer's instructions to turn the charger on and adjust the charging rate. A very fast charge rate is not recommended. If the battery gases excessively, or feels warm to the touch, lower the charge rate.
11. Do not stand with one's face directly over the battery.
12. If sparks occur at the battery when the charger is turned on, turn off the charger and reconnect the charger clips to improve the connection.
13. Match the voltage and manufacturer's recommended amperage charge to the dial setting on the charger. Do not overcharge the battery.
14. If a battery explosion should occur, immediately wash any part of the body or clothing that has come into contact with acid, using plenty of water.
15. Acid spills can be neutralized with a weak ammonia solution, a bicarbonate of soda solution, or by diluting with large quantities of water, applied immediately.

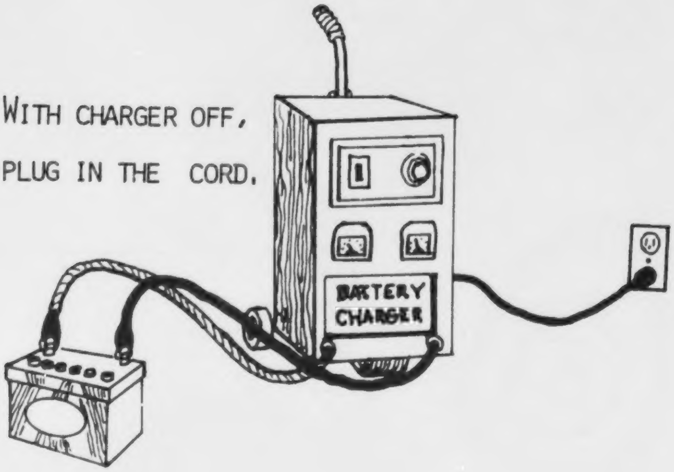
CONNECTING OR DISCONNECTING A BATTERY CHARGER

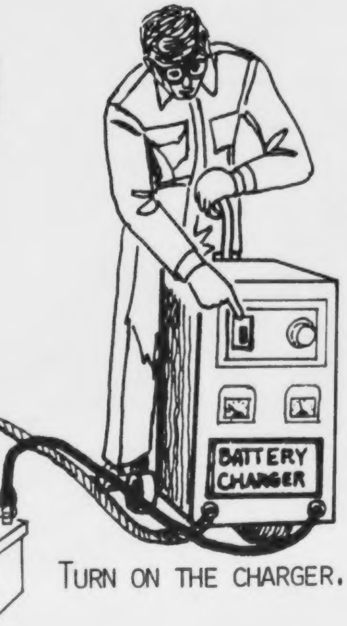
WITH CHARGER OFF AND UNPLUGGED, CONNECT THE LEADS.


BATTERY
CHARGER
+
-
+
-

(POSITIVE TO POSITIVE, NEGATIVE TO NEGATIVE)

WITH CHARGER OFF, PLUG IN THE CORD.


BATTERY
CHARGER


BATTERY
CHARGER

TURN ON THE CHARGER.

BATTERY CHARGER SAFETY QUIZ

NAME ______________________________

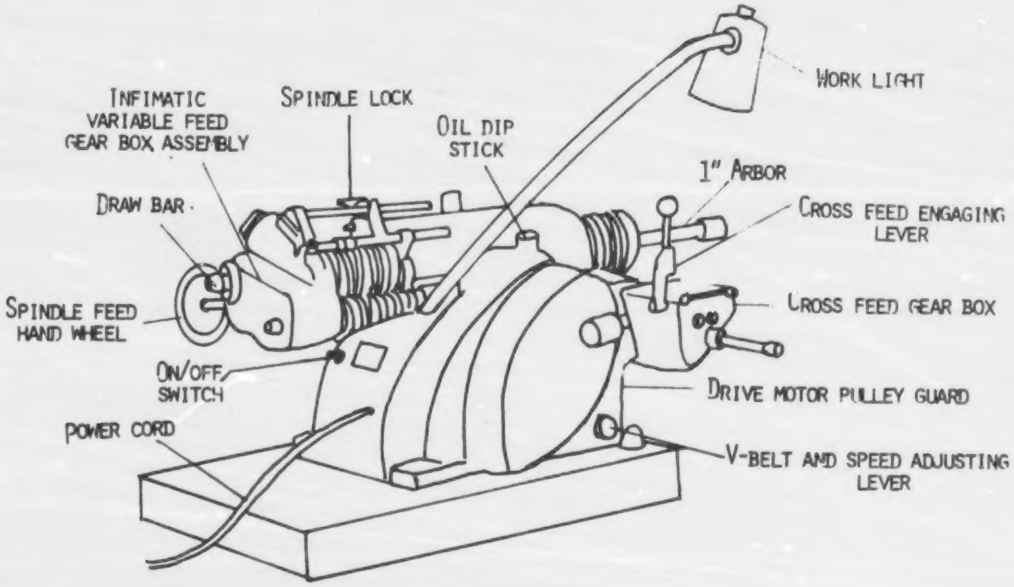
CLASS ______________________________

DATE _________________ GRADE________

(Circle true or false)

1. Never use a match or lighter to inspect the electrolyte level of the battery. T F
2. When connecting the battery cables, connect the ground cable first and disconnect it last. T F
3. It is best to fast charge a battery very quickly, so that it doesn't have time to damage the battery. T F
4. The cell covers must be in place during a charge. T F
5. Batteries shall be charged in an enclosed area. T F
6. Keep one's face directly over the battery while charging it so that the electrolyte can be better observed. T F
7. The battery electrolyte should be slightly overfilled during charging, so the plates will be well covered. T F
8. Attach the charger cables with the positive to the positive battery terminal, and the negative to the negative battery terminal. T F
9. If a spark occurs when the charger is turned on, turn the charger off and reconnect the cables. T F
10. If a battery explodes, one must immediately wash all parts of the body and clothes that might have come in contact with acid, using plenty of water. T F

BRAKE DRUM/ROTER LATHE


WORK LIGHT
INFIMATIC VARIABLE FEED GEAR BOX ASSEMBLY
SPINDLE LOCK
OIL DIP STICK
1" ARBOR
CROSS FEED ENGAGING LEVER
DRAW BAR
SPINDLE FEED HAND WHEEL
CROSS FEED GEAR BOX
ON/OFF SWITCH
DRIVE MOTOR PULLEY GUARD
POWER CORD
V-BELT AND SPEED ADJUSTING LEVER

1. Observe eye protection safety rules.

2. Do not remove the belt guards or shields, or in any way change or short cut the controls and operations.

3. The spindle feed hand wheel will not operate unless the spindle feed engaging lever is in the off position.

4. The feed speed shall be adjusted only when the spindle is turning.

5. Be sure that the drums and rotors are mounted and located accurately and squarely before starting a cut. Ask the teacher to check the setup.

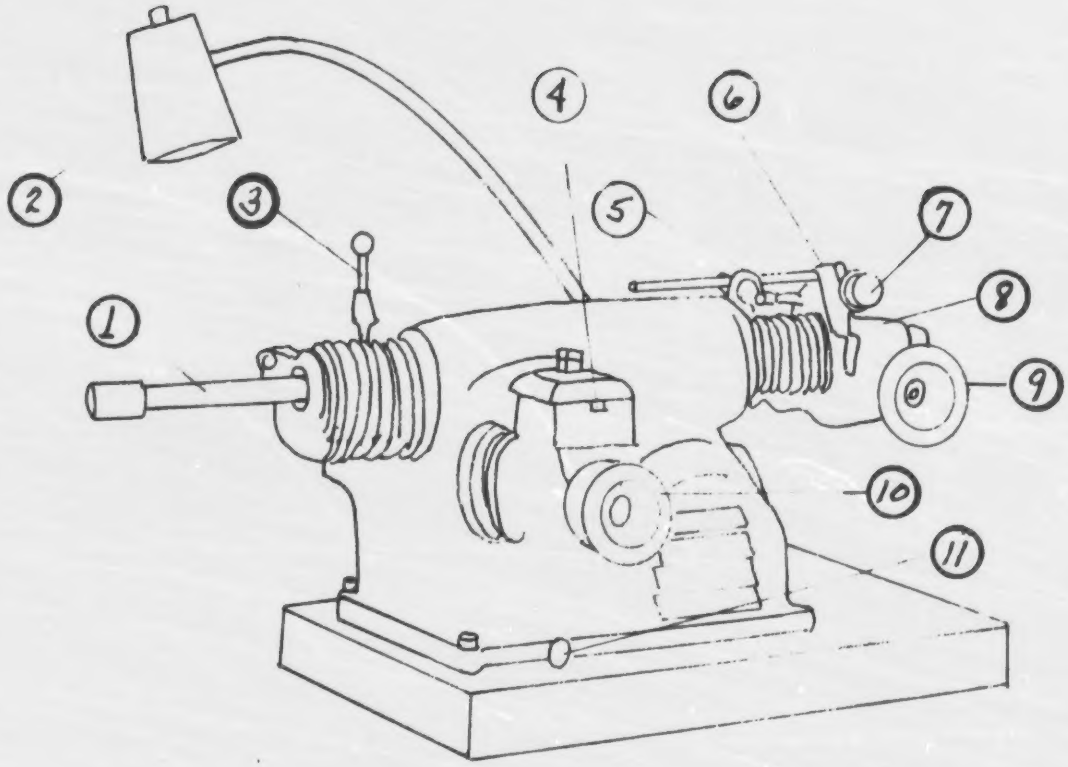
6. Be careful not to let any loose clothing or items of jewelry (rings, wristwatches, necklaces, etc.) get caught in the moving parts. Remove these things if they might catch on moving machinery.

7. Do not overload the lathe. Follow the manufacturer's recommendations.

8. Do not turn on any switch unless one is thoroughly familiar with the operation of the lathe. Obtain the teacher's permission to do this.

9. Keep the floor area around the lathe clean and free from obstacles. Do not clean the lathe or the table with compressed air. Use a counter brush.

BRAKE DRUM/ROTOR LATHE



1 Arbor

2 Work light

3 Cross feed engaging lever

4 Tool bar clamp

5 Spindle lock

6 Spindle feed engaging lever

7 Spindle feed dial

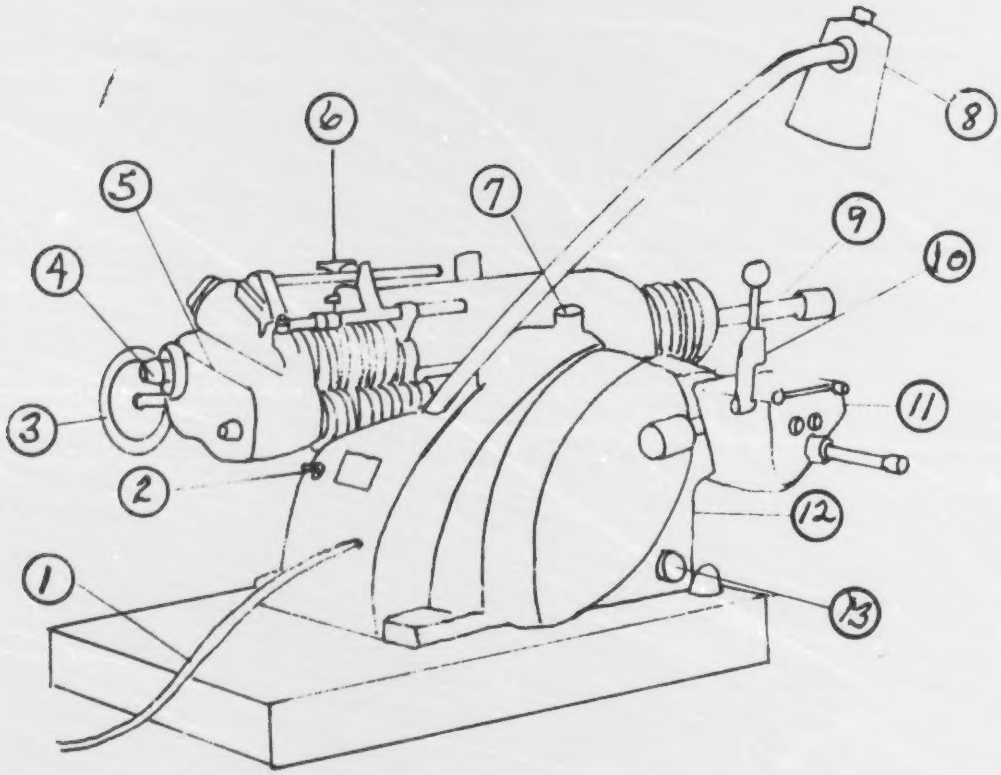
8 Infimatic variable feed gear box assembly

9 Spindle feed hand wheel

10 Cross feed hand wheel

11 Cross slide lock

BRAKE DRUM/ROTOR LATHE



1 Power cord

2 On/off switch

3 Spindle feed hand wheel

4 Draw bar

5 Infimatic variable feed gear box assemply

6 Spindle lock

7 Oil dip stick

8 Work light

9 1" arbor

10 Cross feed engaging lever

11 Cross feed gear box

12 Drive motor pulley guard

13 V-belt and speed adjusting lever

BRAKE DRUM/ROTOR LATHE SAFETY QUIZ

NAME ______________________________

CLASS ______________________________

DATE _______________ GRADE _________

(Circle true or false)

1. Remove belt guards and shields if they are in the way. T F

2. Adjust the feed speed only when the spindle is turning. T F

3. Keep loose clothing away from moving parts. T F

4. Eye protection is not necessary if the shield is used. T F

5. Be sure to step over or around any obstacles around the lathe. T F

6. Do not overload the lathe. T F

7. Make a cut with the lathe before having the teacher check the set-up. T F

8. Do not take time to remount a drum or rotor that is not mounted squarely because the lathe will compensate for it. T F

CAR LIFT

1. Wear eye protection.

2. Obtain permission from the teacher before using the car hoist.

3. Practice using the lift controls with no car on them until they become familiar.

4. Place the car directly over the lift with the rear and front wheels centered over the hoist contact points. Release the brakes and put the transmission in neutral.

    A. Do not direct the driver of the car onto the lift area from any position in front of the car. Stand to one side.

    B. The driver shall not wear safety glasses with restricting-vision side shields while driving a vehicle within the shop.

    C. The driver must have the side window down and the radio turned off.

    D. Only licensed drivers may drive the vehicles, and no one should drive a standard transmission equipped vehicle if he/she is not familiar with it.

5. Position the lifting saddles in the proper location on the vehicle, according to the type of lift being used.

6. Ask the teacher to inspect the location of the lift saddles before the car is raised.

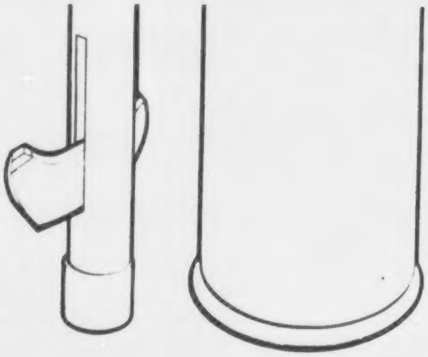
7. Make sure all persons and obstructions are clear before raising or lowering the vehicle.

8. Lift the vehicle a few inches off the floor and recheck the saddle positions.

9. Regulate the control valves to raise both ends of the car at the same time if the lift is the twin-post type.

10. After the vehicle is raised to the full height, close both control valves. Turn the air valve to its neutral position, locking the air in the tanks.

11. The lift should be equipped with a mechanical locking device.



MAKE CERTAIN THE DEVICE IS IN PLACE WHEN THE LIFT IS UP.

(WARNING)

DON'T USE THE LIFT IF IT:

1. jerks or jumps when raised,
2. slowly settles down after being raised,
3. slowly rises, either when in use or when not in use,
4. comes down very slowly,
5. blows oil out of the exhaust line, or
6. leaks oil at the packing gland.

Tell the teacher if any of these problems are observed.

12. If the vehicle has curb feelers installed, cover them or tuck them under the fender as a protection to the eyes and face.

13. When removing the rear axle assembly, rear springs, shackles, or transmission, support the vehicle with the proper stands. (Twin-post type only.)

14. Ask the teacher to check the placement of these stands.

15. Lower the vehicle so that both ends come down at the same time.

16. Check to see that the lift saddles go completely down into the pits before the vehicle is driven off the lift.

17. Report to the teacher if the lift does not operate correctly.

CAR LIFT SAFETY QUIZ

NAME ______________________________

CLASS ____________________________

DATE _______________ GRADE ________

(Circle true or false)

1. One must stand directly in front of the vehicle when directing it on the lift so that it can be carefully centered. T F

2. When the car is raised, place the air valve in neutral to trap air in the tanks. T F

3. When lifting the vehicle, raise one end at a time. T F

4. Check to see that the lift saddles are completely down into their pits before driving the vehicle off the lift. T F

5. It is best to raise the car completely before asking the teacher to check it. T F

6. Use special stands to support the vehicle when removing the rear springs if the lift is a twin-post type. T F

7. Drivers shall not wear safety glasses with restrictive eye shields while driving within the shop. T F

HOT CAUSTIC TANK

1. Wear a face shield, plastic or rubber gloves, long sleeves, and foot protection.
2. Permit no one near the tank during the time that objects are being placed in it or removed from it, unless the person is wearing the proper protective clothing.
3. Obtain permission from the teacher before using the caustic tank.
4. Raise or lower the tank lid with a suitable lifting device so that live steam is not released into the face.
5. Become familiar with the hoist operation before lifting any object with it.
6. Do not place aluminum in the caustic.
7. Wash splashes on the skin immediately, using soap and water.
8. Ask the teacher to light the gas burners. This should not be done by a pupil.
9. Secure the chains with wire so that they can be located for easy hookup to the hoist when they are being removed from the tank.
10. Hose the caustic from the objects by using hot water. Take care not to splash the caustic on anyone.
11. Wash the caustic from any personal protective clothing that was used.

HOT CAUSTIC TANK SAFETY QUIZ

NAME ______________________________

CLASS ______________________________

DATE _______________ GRADE __________

(Circle true or false)

1. Use solvent to wash off any splashes of caustic that get on the skin. T F
2. Obtain permission from the teacher before using the caustic tank. T F
3. Always wear proper safety apparel when using the caustic tank. T F
4. An observer does not need safety apparel when near the caustic tank. T F
5. Do not place cast iron in the caustic tank. T F
6. Turn on the burners under the tank when ready to use it. T F
7. Lift the tank lid while standing directly in front of it. T F
8. Secure the lifting chains with wire so that they can be located for easy hookup to the hoist when they are being removed from the tank. T F
9. Hose off caustic from the objects with hot water. T F
10. Learn how to use the tank hoist before trying to lift heavy objects. T F
11. Do not place aluminum objects in the caustic tank. T F

ENGINE CRANE AND HOIST

1. Obtain permission from the teacher before using a hoist or crane.
2. Place the crane or hoist directly over the object to be lifted. (Transparency)
3. Inspect the chain, cable, or rope each time it is used for lifting.
4. Attach the lifting device to the object, using no less than 3/8 inch diameter bolts. Use large washers and fasten the lifting device firmly to the object so that the head of the bolt is tight against the lifting device.
5. Double check the fastening of the chain, cable, or rope to make sure it is secure, and that it cannot slip from the object being hoisted.
6. The load must be balanced before lifting.
7. Make sure all persons and obstructions are clear before raising or lowering the object. No one is permitted under the vehicle at this time.
8. Keep all hands clear and raise the engine until the motor mounts are clear. Shake the engine from side to side to see that it is free.
9. Raise the engine slowly while watching for any binding. Do not allow the hoist control chain to drag on the vehicle, nor let it catch on any obstructions in the engine compartment.
10. After the engine is free of the vehicle, either move the vehicle back or the hoist forward until the engine can be lowered to the floor. Do not leave the load in a high position on the hoist.
11. If the hoist is suspended from an I-beam and is moved on rollers, use care when the hoist is moved from one point to another so that it will not strike anyone or anything as it is moved.

Hoist

1. Follow instructions 1 through 10 on crane safety.

2. Make sure that the size of the load on any crane or hoist does not exceed its rated load. (OSHA)

Chain

1. It is important to inspect chain slings regularly and to keep a record of individual chain inspection. Before inspecting, clean the chains so that marks, nicks, wear, and other defects can be seen.

2. Each link should be inspected for twists or bends, nicks or gouges, excessive wear at bearing points, stretched links, distorted or damaged master links, coupling links, or attachments.

   Each link or attachment having any one of the defects must be marked with paint to plainly indicate the rejection, and it shall be eliminated from service until properly repaired.

3. When using the chain, avoid sudden jerks in lowering or lifting.

4. Make sure the load is balanced.

5. Never overload the chain.

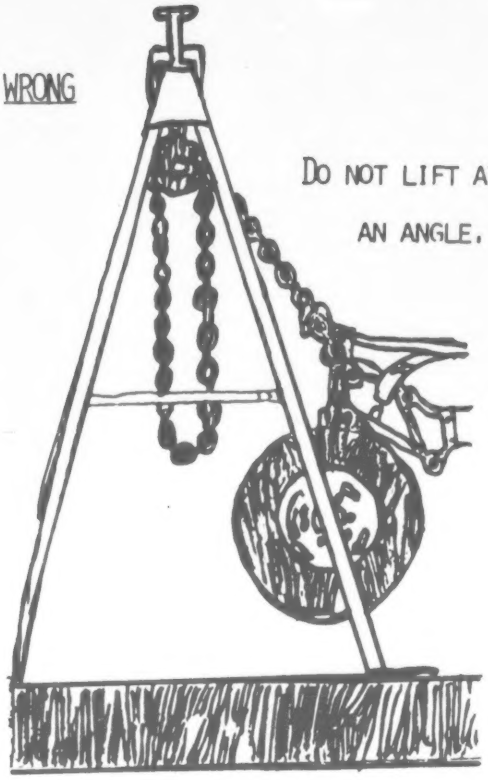
6. Free all twists, knots, or kinks. Don't drop the load on the chain.

7. Chains should be oiled before prolonged storage.

8. Store chains on an A-frame in a clean dry place.

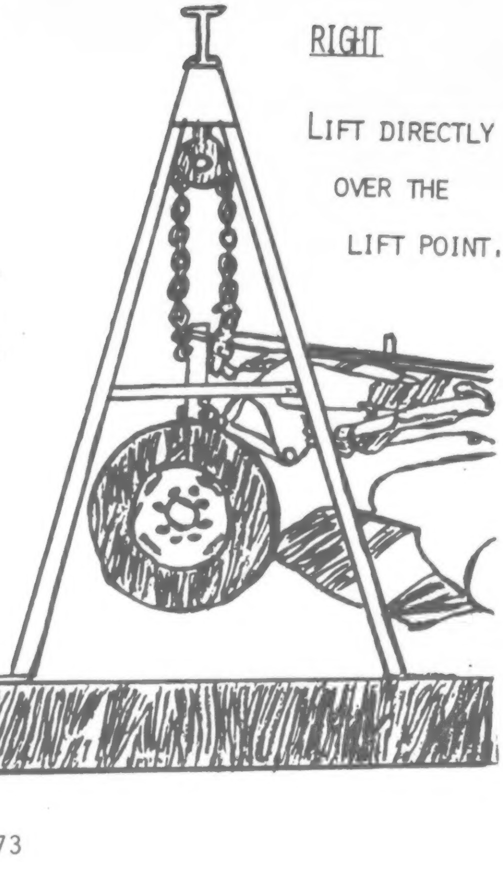
9. Do not use the hoist chain for anything but a lifting device.

PLACE HOIST DIRECTLY OVER OBJECT



WRONG

DO NOT LIFT AT AN ANGLE.



RIGHT

LIFT DIRECTLY OVER THE LIFT POINT.

ENGINE CRANE AND HOIST SAFETY QUIZ

NAME ______________________________

CLASS ______________________________

DATE _______________ GRADE _________

(Circle true or false)

1. Attach the lifting device to the object with bolts that are no less than 1/4 inch in diameter.	T	F
2. Keep all hands clear and raise the engine until the motor mounts are clear; then shake the engine from side to side to see if it is free.	T	F
3. Be sure that someone is under the vehicle to check the engine while it is being raised.	T	F
4. After the engine is free of the vehicle, move the vehicle out of the way and keep the engine at eye level so that other pupils will not walk into it.	T	F
5. Place the crane or hoist slightly forward of the object to be raised so that the object will swing clear when it is lifted.	T	F

ENGINE ANALYZER

1. Obtain the teacher's permission before using the engine analyzer.

2. The engine analyzer is top-heavy and can tip over easily. Always use two pupils to move it from one place to another.

3. The engine must be turned off while the analyzer leads are attached to it.

4. Check the leads to see that they cannot fall into the fan blades or into the engine belts. Also, make sure that the leads do not come into contact with the exhaust manifold.

5. The engine operator must obey the instructions of only one person that is making the tests. Instructions coming from a group of mechanics is confusing and dangerous. Instructions must be clear and understood by all mechanics. "Crank it over" does not mean "Start it up." "Bump it" does not mean "Pump it," etc.

6. No one is to have his/her hands resting on any part of the engine or radiator during the testing.

7. The hand brake must be on, and the transmission in park if the vehicle has an automatic transmission, or in neutral if it has a standard transmission.

8. The shop exhaust ventilator tube must be in place with the exhaust fan turned on.

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Engine Analyzer Safety Quiz

Name ____________________

Class ____________________

Date ____________ Grade ________

(Circle true or false)

1. In order to avoid confusion, only one person should move the analyzer from one place to another. T F

2. Make sure the analyzer leads do not contact the intake manifold. T F

3. If several mechanics are making the test, they must all be responsible for giving the engine operator instructions. T F

4. No one shall rest his/her hands on the engine or radiator during the tests. T F

5. Keep the analyzer leads away from the fan blades or fan belts. T F

6. The engine must be running during the analyzer hookup in order to see that the meters are working properly. T F

7. Hook up the shop exhaust ventilation system only if the shop begins to smoke. T F

8. The vehicle hand brake must be applied during the test. T F

HIGH SPEED WHEEL BALANCER

1. Obtain permission from the teacher before using the balancer.
2. Observe eye safety regulations.
3. Jack up the vehicle so that only the wheel being balanced is off the floor by about 2 inches.
   - A. Follow the jack safety instructions.
   - B. Locate the jack saddle directly under the part to be raised.
4. Set the car hand brake, if possible.
5. Check to see that the wheel turns freely. Eliminate all friction drag on the wheel, such as: brakes, bearings, etc.
6. Remove any clumps of mud, dirt, or grease from the wheel rim. Remove any large gravel or other objects from the tire tread. Use safety stands under the car if it is necessary to get under it.
7. Ask the teacher to check the installation before spinning the wheel.
8. Do not allow anyone to stand in a direct line with the spinning wheel.
9. Do not stop the rotation of the wheel with the car brakes.
10. If the wheel vibrates excessively, stop spinning it and check the installation. Also check for loose wheel bearings or lug nuts. If everything looks satisfactory, ask the teacher to check it over.

HIGH SPEED WHEEL BALANCER SAFETY QUIZ

NAME ____________________

CLASS ____________________

DATE ______________ GRADE ________

(Circle true or false)

1. The safest place to stand and observe the balancing is in a direct line with the wheel. T F
2. Spin the wheel to see if it needs balancing before getting the teacher to check the installation. T F
3. Eye safety regulations must be observed at all times. T F
4. Never stop the wheel from rotating with the car's brakes during the balancing. T F
5. All four wheels must be off the floor during the balancing of one wheel. T F
6. Clean off the rim of the wheel before balancing it. T F
7. If the wheel vibrates excessively when one starts spinning it, don't be alarmed. Continue with the balancing. T F

HYDRAULIC FLOOR JACK

1. Know exactly how to operate the lifting and lowering controls of the hydraulic jack before using it. Practice without a load on the saddle, if unsure.

2. The operator must make sure that the jack used has a rating sufficient to lift and sustain the load. (OSHA)

3. Do not use the jack if there is any doubt about its safe operation.

4. Do not place the jack or stand under an inclined surface. Always place it under a horizontal or flat surface to avoid slipping. (OSHA)

5. Locate the jack saddle directly under the part to be raised. Take care that the lifting point is solid. Avoid contact with the oil pans, fuel tank, exhaust pipes, etc.

6. Do not work under any car or object that is supported by a jack alone. Always place safety stands under the frame or wheel support systems before getting under the car.

7. Do not permit anyone to work on the vehicle while it is being raised or lowered. Never raise or lower a vehicle if someone is underneath.

8. Wear eye protection.

9. If the jack must be left under the vehicle, the handle should be left in the raised position or positioned under the vehicle so other pupils will not bump into it. This makes it easier to see and does not cause a tripping hazard.

10. Do not work under a raised car until the teacher's approval has been received.

11. Use only school jacks to lift the vehicles in the auto shop.

12. Operate the jack handle only while facing the load.

13. When lowering the vehicle, do so slowly, after checking to see that all tools, drop lights, creepers, etc. are clear.

14. Each jack shall be thoroughly inspected every six months. (OSHA)

15. Jacks which are out of order shall be tagged accordingly and not used until repairs are made. (OSHA)

16. Do not continue to use a jack that malfunctions. Report any unusual actions to the teacher. (Transparency)

HYDRAULIC JACK MALFUNCTIONS

1. Jerks or jumps when raised.
2. Slowly settles down after being raised.
3. Slowly rises when not in use.
4. Rises slowly when in use.
5. Comes down very slowly.
6. Blows oil out of the exhaust line.
7. Leaks oil at the packing gland.

(Report any malfunction to the teacher at once.)

HYDRAULIC FLOOR JACK SAFETY QUIZ

NAME ______________________________

CLASS ______________________________

DATE ________________ GRADE ________

(Circle true or false)

1. It is the responsibility of the school to make sure that the jack that is being used has sufficient rating for the load. T F
2. Do not place the jack under an inclined surface. T F
3. It is considered safe to crawl under a vehicle that is supported by the jack alone if one prepares oneself to get out of the way very quickly. T F
4. When lowering the vehicle to the floor, do it very quickly so no one can slip underneath before it is lowered. T F
5. It is permitted to use the bumper jack from the trunk of the car to raise the car, if all other jacks are in use. T F
6. The engine oil pan is flat and therefore can be used as a contact point to lift the car. T F
7. Do not permit anyone to work on the car while it is being raised or lowered. T F
8. Do not use the jack if there is any doubt about its safe operation. T F
9. Face away from the vehicle when raising it with the jack so that one can move away quickly. T F
10. Know exactly how to operate the jack before trying to lift a vehicle. T F
11. It is permissible to use a jack that has been tagged "Out of order" if a person is careful in its use, and the teacher is not looking. T F

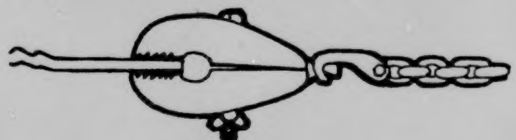
HYDRAULIC JACKS—USE IN THE BODY SHOP

The hydraulic jack is one of the most useful tools in a body shop. But, whether it is used as a frame straightener or as a simple body lift, a jack can be as dangerous as it is useful.

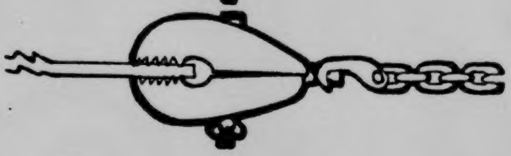
PULLING--When using the jack for pulling jobs, the clamp or chain may let go for several reasons: the clamp teeth may be unclean or worn; the clamp may have been fastened to undercoating rather than the metal itself; the clamp may not have been tightened enough; the metal may give way, especially when the operator is pulling a rusted panel; the chain or clamp may break. The following rules should be observed before starting a pulling job.

1. Clean the teeth of clamps regularly with a wire brush.

BEFORE CLEANING



AFTER CLEANING



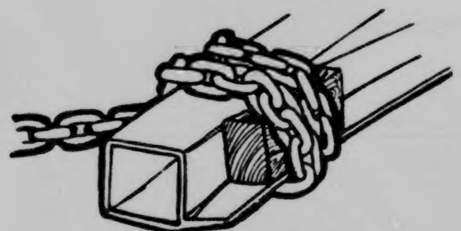
2. Inspect clamps and chains for wear before use. Replace the clamp if its teeth are worn. Replace the chain if it is nicked or otherwise damaged. All chains should be replaced at regular intervals, regardless of wear.

3. Make sure all undercoating is removed where the clamp is attached.

4. When the clamp is to be attached to a rusted panel, tack weld a metal brace to the panel for support.

5. Have the car on its wheels or bolted to mobile safety stands when pulling. This will prevent the car from falling off the stand during the pull.

6. Wrap the chain around a frame member several times. This will spread the load over as many links as possible. Make sure the chain isn't twisted.



7. If the chain links are drawn across sharp corners, provide padding for the links so that they won't break when pressure is applied.

8. Make sure the chain hook is connected to a link with a firm grip. Test it before applying hydraulic pressure.

9. Cover the chain and clamp with a heavy blanket before starting the pull. They will be less likely to fly back at the operator if a slip or break occurs.

10. Stand to either side of the jack--never behind it. Make sure all others are clear of the jack before starting the pull.

11. If possible, stand behind a strong acrylic plastic or safety glass shield during all but the lightest pulls.

12. Make sure all body attachments are screwed on tightly. Be careful not to damage the threads on the attachments.

Working on a car held up by only a hydraulic jack can lead to a serious accident. Always use the "horses" or jack stand. They will keep the car from falling on the operator if the jack is accidently released. Check and recheck all safety devices and latches on hydraulic jacks. Don't try to bypass them.

AUTOMOTIVE END LIFT

1. Know exactly how to operate the lifting and lowering controls of the end lift before using it. Check with the teacher and practice without a load on the saddles if unsure.

2. The operator must make sure that the jack which is used has a rating sufficient to lift and sustain the load. (OSHA)

3. Do not use the end lift if there is any doubt about its safe operation.

4. Position end lift saddles under the front or rear bumper and carefully locate the manufacturer's approved lifting points on the vehicle being lifted. CAUTION! All vehicles cannot be lifted by the bumper.

5. Slowly lift the saddles to about one inch from the lift points on the vehicle and adjust the lift so that they are in the exact and correct location.

6. The teacher must check the position of the lift if it is the first time that this type of vehicle has been lifted by the pupil.

7. Place the transmission in neutral and release the hand brake if the front end of the vehicle is being raised.

8. Slowly raise the end lift saddles until contact with the vehicle is made.

9. Permit no one to work on or under the vehicle while it is being raised or lowered.

10. Raise the vehicle slowly to the height desired.

11. Place safety stands under the vehicle at the frame or the suspension supports and lower it either to the stands or to the safety stop position on the end lift. Do not work under a car that is supported by the end lift alone.

12. When lowering the vehicle with the end lift, raise it to release the safety stop and remove the safety stands.

13. Check to see that all tools, tool boards, creepers, drop lights, etc. are clear and that no one is working on or under the vehicle; then slowly lower it to the floor.

14. Replace the end lift in its proper place in the shop.

AUTOMOTIVE END LIFT SAFETY QUIZ

NAME ______________________________

CLASS ______________________________

DATE ______________ GRADE ________

(Circle true or false)

1. All vehicles can be lifted by their bumpers. T F

2. Someone must be under the vehicle while it is being raised, in case something starts to slip. T F

3. Safety stands are not needed when an end lift is used, because it has built-in safety stops. T F

4. Place the transmission in neutral and release the parking brake if the front end of the vehicle is being raised. T F

5. The teacher must check the position of the saddles if it is the first time that a pupil has lifted this type of vehicle. T F

6. Check to see that the floor area under the vehicle is clear before it is lowered to the floor. T F

SOLVENT TANK

1. Wear eye protection at all times.

2. Solvent will remove all natural oils from the skin. Hands shall be washed with soap and water and thoroughly dried as soon as possible after contamination. Persons with sensitive skin need to wear rubber or plastic gloves.

3. Be sure that the fluid nozzle is directed downward toward the reservoir before turning on the pump switch.

4. Solvent becomes very slippery when splashed on the floor. This is especially true if water is also present. Wipe up all spills immediately.

5. Solvent will burn. Permit no sparks, open flames, or very hot metals near it.

6. Upon completion of the use of the solvent tank, turn off the pump switch.

SOLVENT TANK SAFETY QUIZ

NAME ______________________________

CLASS ______________________________

DATE _______________ GRADE _______

(Circle true or false)

1. Solvent is safe and will not burn. T F

2. Wipe up spills immediately because solvent makes floors slippery. T F

3. Solvent is a good skin conditioner. T F

4. Wear eye protection at all times. T F

5. The fluid nozzle should be directed upward before the pump switch is turned on. T F

STEAM CLEANER

1. Obtain permission from the teacher before using the steam cleaner.

2. Wear protective clothing. Face shield, gloves, rubber footwear, and a rubber apron shall be worn when handling the steam cleaning soap or the steam nozzle.

3. Work in a well-ventilated area.

4. Add soap according to the manufacturer's instructions.

5. Turn the water valve on fully.

6. When water is flowing from the steam nozzle, turn on the burner control and adjust it to the limit set by the manufacturer. Check with the teacher if unsure of this setting. Do not overheat the boiler tubes.

7. Permit no one else in the steam room while using the steam cleaner, unless the person is wearing protective clothing.

8. When steam is coming from the nozzle, open the soap valve and direct the steam to the object being cleaned. Do not lay the nozzle down unless a special place to do so has been designated by the teacher.

9. Shut down the steam cleaner if any unusual noise is heard from the unit, or if steam pressure seems to rise rapidly. Report this to the teacher.

10. Shut down the steam cleaner by turning off the gas burner control. Wait for the steam from the nozzle to turn to water, then turn off the water valve. Be sure that the soap valve is off.

11. Place the hose and nozzle in the proper location, then hose down the floor and dry it with a squeegee.

12. Clean the protective clothing with solvent and/or soap and water and put all articles in their proper places.

STEAM CLEANER SAFETY QUIZ

NAME ______________________________

CLASS _____________________________

DATE _______________ GRADE ________

(Circle true or false)

1. The water valve shall be turned on fully before turning on the burners. T F

2. The gas burner control must be turned on fully. T F

3. Wear protective clothing while steam cleaning. T F

4. Never lay the steam nozzle down while steam is coming from it unless a special place has been designated by the teacher. T F

5. If any unusual noise comes from the steam cleaner, ignore it, because safety valves will protect the user. T F

6. When turning off the steam cleaner, first turn off the water valve. T F

7. Obtain permission from the teacher before using the steam cleaner. T F

STORAGE BATTERY

REST IN
PEACE
BATTERY

The automotive storage battery is one of the most potentially dangerous objects in the automotive shop. It is filled with corrosive acid and the gases that are given off from it are extremely explosive and also poisonous. Great care must be observed in handling the battery. Most accidents occur when batteries are jumped or charged.

1. Obtain permission from the teacher before servicing or charging a storage battery.
2. EYE PROTECTION MUST BE OBSERVED. Face, hand, and clothing protection shall be used.
3. Always use the proper instruments for testing a battery. Do not short across the battery terminals. The resulting spark could cause an explosion.
4. Avoid overfilling a battery, especially if it is soon to be charged.
5. Handle battery and acid with care. Immediately wash any part of the body or clothing that comes into contact with acid. Transport a battery properly by using a battery carrier. If the cell covers have been removed, replace them before moving the battery.
6. An acid spill can be neutralized with a weak ammonia solution or with a bicarbonate of soda solution, or one can dilute the spill by using large quantities of water, applied immediately. Avoid spilling or dripping electrolyte when using a hydrometer.
7. Deluge showers and eye baths should be provided adjacent to the battery charging area. If acid gets in the eyes, flush them out immediately with large amount of water and notify the teacher. (OSHA)

STORAGE BATTERY (CONT.)

8. Batteries should be stored and charged only in well-ventilated areas. Do not breath fumes from the battery. (OSHA)

9. All sources of ignition should be remote from the battery charging or storage area. There must be no smoking, no lighted matches or lighters, and no sparking from tools. (OSHA)

10. Do not work on batteries during discharge or charge.

11. Metal jewelry such as rings, bracelets, or necklaces shall not be worn around batteries.

12. Battery charger shall be connected or disconnected only when the charger is turned off and unplugged, and the vent caps are in place.

13. Remove and replace battery clamps in the correct order:

    A. Battery removal--disconnect the grounded clamp first.
    B. Battery installation--connect the grounded battery clamp last.

14. Disconnect the ground cable while working on any rotating parts of the vehicle.

15. Never stand with the face directly over a charging battery. The fumes are deadly, and an explosion could spray acid into one's face.

16. Do not jump a frozen battery.

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STORAGE BATTERY SAFETY QUIZ

NAME____

CLASS____

DATE____________ GRADE________________________

(Circle true or false)

1. Never stand with the face directly over a charging battery. T F
2. Do not work on batteries while they are being charged or discharged. T F
3. Place extra water in the battery during charging to compensate for the loss of water at this time. T F
4. Acid spills can be neutralized by solvent. T F
5. Eye protection must be observed when working with a battery. T F
6. Batteries shall be charged in a sealed area to keep deadly fumes from escaping. T F
7. When removing the battery from a vehicle, the ground cable shall be disconnected last. T F
8. A person must test a battery by shorting a pair of pliers across the terminals. T F
9. Disconnect the ground cable while working on any rotating part of the drive line, such as the universal joints. T F
10. When attaching a battery to the vehicle, fasten the ground cable last. T F
11. If acid is splashed in the eyes, flush them out with plenty of water and notify the teacher. T F
12. The vent caps should be removed while transporting a battery. T F

TIRE CHANGER (AUTO)

1. Removing and replacing tires on rims can be dangerous. Do not attempt this job unless thoroughly instructed on the use of the equipment. Always get the teacher's permission before using it.

2. Wear eye protection.

3. Each manufacturer of tire-changing equipment has step-by-step procedures to follow for that particular piece of eqipment. Follow these steps. Do not take chances with shortcuts.

4. Use only the approved tools needed for the job.

5. Do not be careless.

6. If the tire does not seem to fit the rim, do not force it. Notify the teacher that there is a problem.

7. Inspect the rims for cracks and other damage.

8. Do not attempt to weld on an inflated tire-rim assembly.

9. Magnesium rims are brittle. Handle them with care and keep fire away from this type of rim.

10. Always exhaust all the air from the tire before attempting to demount it.

11. Never let go of a tire iron when prying. The iron may spring back with terrific force.

12. Do not try to remove large sections of the tire from the rim with each bite.

13. Stay well-balanced. Do not lean over the wheel or rim assembly.

14. Keep the floor area clear of debris. Sand, gravel, or mud can cause one to slip.

15. Use a rubber lubricant to aid the removal and replacement of the tire on the rim.

16. Keep hands clear of any power-assisted tools.

INFLATION OF TIRES

1. When inflating tires, use an extension hose with a clip-on chuck.
2. Keep the hands and face clear of the expanding bead.
3. Never place the fingers between the tire bead and the rim.
4. The tire bead will snap into place with a loud "pop." Be prepared for it.
5. Do not inflate a tire that has been run flat. Remove it and inspect the rim and tire for internal damage.
6. If the tire bead does not seat in at 35 psi., deflate the tire, reposition it slightly on the rim, lubricate the bead, and reinflate.

TIRE CHANGER (AUTO) SAFETY QUIZ

NAME________________________________

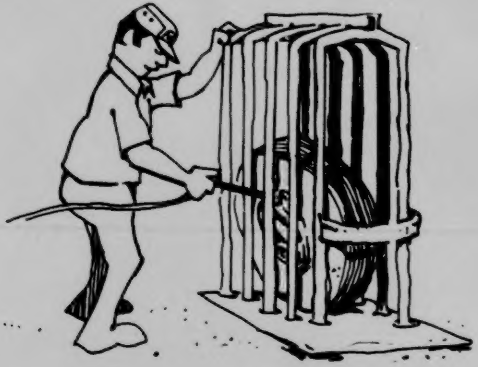
CLASS________________________________

DATE______________ GRADE________________

(Circle true or false)

1. Try to improve speed in the mounting of tires by skipping some of the procedures recommended by the manufacturer. T F
2. If the tire does not seem to fit the rim, apply more rubber lubricant and force it on. T F
3. Do not attempt to weld on an inflated tire-rim assembly. T F
4. Keep fire away from magnesium rims. T F
5. Remove as large a section of the bead from the rim as can be done at one time. T F
6. Do not let go of a tire iron when prying the bead from the rim. T F
7. Retain some of the air in the tire when demounting it in order to protect the bead. T F
8. Use motor oil as a lubricant when mounting tires. T F
9. Never place the fingers between the rim and the bead when inflating the tire. T F
10. If the bead snaps into place on the rim with a loud "pop" while it is being inflated, something is wrong, and the tire should be demounted. T F

TIRE CHANGER (TRUCK)



1. Follow safety rules number 1 through 16 in the Auto Tire Changer Unit.

2. IMPORTANT: Many truck and tractor tires have split rims. Changing these tires is hazardous for inexperienced persons, especially if proper equipment is not available. If a tire explodes, a lock ring blows off, or a hydraulic bead breaker slips, a person could be struck with instant killing force. Do not attempt this without the teacher's approval.

3. Get help when handling large tractor tires. They are so heavy that they can tip and fall easily, injuring the back or crushing the legs.

4. Always exhaust all the air from a single tire and from both tires of a dual assembly prior to removing any rim or wheel components, such as nuts and rim clamps. Check the valve stem by running a piece of wire through the stem to make sure it is not plugged.

5. Use caution when removing side ring, flange, or lock ring. Support them on the thigh and roll them slowly to the ground.

6. Do not reinflate a tire that has been run flat without first inspecting the tire, rim, and wheel assembly. Double check the side and lock rings for damage and make sure that they are secure in the gutter before inflation.

7. A safety tire rack, cage, or equivalent protection shall be provided and used when inflating, mounting, or demounting tires installed on split rims, or rims equipped with locking rings or similar devices. (OSHA).

TIRE CHANGER (TRUCK) SAFETY QUIZ

NAME ______________________________

CLASS ______________________________

DATE ____________ GRADE ______________

(Circle true or false)

1. Get help when handling large tractor tires. T F
2. Always exhaust all air from the tire before removing any rim components. T F
3. Split rims are dangerous because they are too heavy. T F
4. Check to see that all the air is out of the tire by sticking a wire through the tube. T F
5. Always use a safety cage when inflating tires installed on split rims. T F
6. Carefully inspect a tire that has been run flat before it is inflated. T F
7. Always obtain permission from the teacher before changing truck or tractor tires. T F

VALVE RECONDITIONER

1. Wear eye protection at all times.
2. Obtain permission from the teacher before using the valve reconditioner.
3. Long hair and loose clothing must be contained.
4. Keep the floor area around the machine clean, dry, and free from debris.
5. Do not grind any valve unless one is completely familiar with the machine. Practice with a spare valve and move the controls to learn the action before turning on the machine.
6. Check and adjust the grinding angle and adjust the depth stop so the valve stem cannot be ground.
7. Make no adjustments with the grinding wheel turned on.
8. Make several light cuts rather than any heavy ones.
9. If the normal sound of the grinder changes, shut it off immediately and notify the teacher.
10. Do not allow any distractions to occur while using the grinder. Concentrate on the job.
11. Turn the grinder off if the machine must be left even for only a moment.

VALVE RECONDITIONER SAFETY QUIZ

NAME______________________________

CLASS______________________________

DATE______________GRADE______________

(Circle true or false)

1. Do not make adjustments on the machine while the grinding wheel is turning. T F

2. If the normal sound of the grinder changes, hurry and finish grinding in case the machine stops. T F

3. Keep the floor area around the grinder clean, dry, and free of debris. T F

4. Keep the grinder running even if it is only left for a moment, so others will know it is still in use. T F

5. Long hair and loose clothing must be contained. T F

6. Heavy cuts are better than light ones because the grinder does not have to run so long. T F

REFERENCES

Materials were selected and reviewed from the following sources, and in some instances were incorporated in the production of the preceding unit.

Adams, Virgil, Auto Mechanics Teacher, Wichita High School Heights

Ammco Tools, Inc.

California State Safety Guide, "Industrial Arts Safety Instruction"

CM Chain Co., "Chain Safety"

U. S. Dept. of Labor, "General Industry Safety and Health Standards", OSHA #2206

Hawaii State Dept. of Education, "Instructional Guide for Auto Mechanics" and "Industrial Education Safety Instructional Guide"

Kansas State Safety Guide, "Safety Practices in the Auto, Diesel, and Agriculture Mechanics Shops." by Janice Parr, Kansas Curriculum Materials Dissemination Center, Pittsburg State University

National Institute for Occupational Safety and Health, NIOS, "Health and Safety Guide". U.S. Dept. of Health, Education, and Welfare.

Ohio State Safety Guide , "Industrial Arts and Vocational Education Safety"

Oklahoma State Safety Guide, "Accident Prevention for Industrial Arts, Vocational and Technical Education Programs", Oklahoma State Board of Vocational and Technical Education

Shawnee Mission Public Schools Safety Guide, "Safety Guide"

Utah State Safety Guide, "Industrial Education Safety Recommendations and OSHA Standards"

Washington State Industrial Arts Safety Guide

Wyoming State Safety Guide, "Occupational Education Safety Manual"

AMMETER

1. Disconnect the ammeter from the circuit before servicing or repairing it.
2. Do not use an ammeter until the teacher has provided proper instruction in its use.
3. Unplug the circuit from the power source before changing meter leads.
4. Use an ammeter only on an ungrounded surface.
5. Always stand on an ungrounded surface when using an ammeter.

AMMETER SAFETY QUIZ

NAME ____________________________

CLASS____________________________

DATE _____________ GRADE________

Read each statement carefully and record the best choice.

_____ 1. When using an ammeter:

A. always use uninsulated meter leads.
B. be sure to connect the ammeter in parallel with the power source.
C. stand on an ungrounded surface.
D. do both B and C.

_____ 2. When connecting an ammeter into an active circuit:

A. unplug the circuit from the power source.
B. use uninsulated meter leads.
C. place the meter on an ungrounded surface.
D. do both A and C.

_____ 3. Before servicing or repairing an ammeter:

A. check to see if the needle is on zero.
B. disconnect the meter from the circuit.
C. place the meter on a grounded surface.
D. do both B and C.

Key

1. C
2. D
3. B

CATHODE-RAY TUBE

1. Cathode-ray tubes must be handled with great care. They are an extreme implosion hazard if broken.

2. The teacher shall always be present when pupils are handling or deactivating a cathode-ray tube.

3. A face shield and gloves must be worn when handling cathode-ray tubes.

4. The room should be cleared of people when handling cathode-ray tubes.

5. Cathode-ray tubes store a high electrical potential. A severe shock can occur if the tube is not properly grounded.

6. A cathode-ray tube should be placed in a cardboard carton when it is carried.

CATHODE-RAY TUBE SAFETY QUIZ

NAME ______________________

CLASS ______________________

DATE ____________ GRADE ______

Read each statement carefully and record the best choice.

_____ 1. When handling a cathode-ray tube:

A. clear the room of people.
B. have the teacher present.
C. wear a face shield and gloves.
D. do all of the above.

_____ 2. Cathode-ray tubes are dangerous because:

A. they have a small neck.
B. they are an extreme implosion hazard.
C. they store a high electrical potential.
D. they are both B and C.

_____ 3. When carrying a cathode-ray tube:

A. the teacher should be present.
B. the cathode-ray tube should be held by its neck.
C. the cathode-ray tube should be placed in a cardboard carton.
D. be sure to have both A and C.

Key

1. D
2. D
3. D

CIRCUIT BOARDS AND KITS

1. Never experiment with circuits unless one has been instructed to do so.
2. Keep the chassis or case clear of grounded objects.
3. Be sure all capacitors are discharged.
4. Disconnect the power source before making adjustments to the circuits.
5. Always check the circuits with a voltmeter or test lamp to determine the values and dangers that can be encountered.
6. Always stand on an ungrounded surface when using a circuit board or working on a kit.
7. Use an isolation transformer when working with 117 volts AC.

CIRCUIT BOARDS AND KITS SAFETY QUIZ

NAME ______________________________

CLASS ______________________________

DATE _______________ GRADE _______

Read each statement carefully and record the best choice.

_____ 1. When using 117 volts AC:

- A. always use an isolation transformer.
- B. always use an indicator lamp.
- C. always keep the chassis or case clear of grounded objects.
- D. do both A and C.

_____ 2. For one's own protection, one should:

- A. be sure all capacitors are charged.
- B. be sure all capacitors are discharged.
- C. stand on a grounded surface.
- D. do both B and C.

_____ 3. When wiring a circuit board or kit:

- A. never experiment with the circuits.
- B. never place the board or kit on an ungrounded surface.
- C. never disconnect the power source.
- D. never do both A and B.

_____ 4. When making adjustments on an active circuit:

- A. stand on an ungrounded surface.
- B. disconnect the power source, when it is possible.
- C. stand on a grounded surface.
- D. do both A and B.

_____ 5. To determine the values and dangers encountered in using a circuit board or assembling a kit:

- A. read the lab manual carefully.
- B. use a moistened finger.
- C. check the circuits with a test lamp or voltmeter.
- D. do both A and C.

Key 1. D, 2. B, 3. A, 4. D, 5. C.

ETCHED-CIRCUIT P C BOARDS

1. Most chemicals used to make etched-circuit P C boards are flammable. Do not use them near heat or flame.

2. Developers such as those used on P C contact film and P C boards should be used only where there is adequate ventilation.

3. Rubber gloves should be worn when working with any of the chemicals used to make etched-circuit P C boards.

4. None of the chemicals used to make etched-circuit P C boards should be allowed to come in contact with the eyes, skin, or mucous membranes (inner nose or mouth).

5. The chemicals used to make etched-circuit P C boards must not be swallowed. They are poisonous.

6. It is important not to puncture the cans or spray the chemicals directly on the skin when using chemicals contained in spray cans.

ETCHED-CIRCUIT P C BOARDS SAFETY QUIZ

NAME ______________________________

CLASS ______________________________

DATE _______________ GRADE _______

Read each statement carefully and record the best choice.

_____ 1. Most chemicals used to make an etched-circuit P C board are:

A. stored in glass bottles.
B. flammable.
C. highly caustic.
D. both B and C.

_____ 2. When using chemicals in spray cans:

A. avoid direct contact with the spray.
B. do not use them around heat or flame.
C. do not puncture the can.
D. observe all of the above.

_____ 3. When working with chemicals that are used to make etched-circuit P C boards:

A. work in a room with no light.
B. keep all the windows tightly closed.
C. protect the hands with rubber gloves.
D. do none of the above.

_____ 4. If one is using a P C contact film developer or a P C board developer, one should:

A. be sure to have adequate ventilation.
B. keep all the windows tightly closed.
C. work in a room with no light.
D. do both A and C.

_____ 5. When making an etched-circuit P C board:

A. never spill any of the chemicals.
B. never swallow any of the chemicals.
C. never inhale the fumes from the chemicals.
D. remember both B and C.

_____ 6. When working with the chemicals used to make etched-circuit P C boards:

A. never pour them into metal containers.
B. never allow them to be used indoors.
C. never allow them to come into contact with the eyes, skin, or mucous membranes.
D. Observe both B and C.

Key

1. B

2. D

3. C

4. A

5. D

6. C

MULTIMETER

1. Do not use a multimeter until the teacher has given proper instruction in its use.
2. Do not touch the metal parts of the test leads when making circuit tests.
3. Always stand on an ungrounded surface when using a multimeter.
4. Always connect the negative lead first when taking measurements with a multimeter.

MULTIMETER SAFETY QUIZ

NAME ____________________________

CLASS ___________________________

DATE _______________ GRADE _____

Read each statement carefully and record the best choice.

_____ 1. When making circuit measurements with a multimeter:

A. zero the ohms scale first.
B. always connect the positive lead first.
C. do not touch the metal parts of the test leads.
D. do both A and C.

_____ 2. When using a multimeter:

A. always connect the positive lead first.
B. stand on an ungrounded surface.
C. always connect the negative lead first.
D. do both B and C.

_____ 3. Do not use a multimeter until:

A. the teacher has given proper instruction it its use.
B. the ohms scale has been zeroed.
C. the battery has been checked.
D. both A and B have been done.

Key

1. C
2. D
3. A

OSCILLOSCOPE

1. Do not use an oscilloscope until the teacher has given proper instruction in its use.

2. Disconnect an oscilloscope from the circuit and power source before servicing or repairing it.

3. Examine the power cord for defects each time the oscilloscope is used.

4. Do not touch the metal parts of the test leads when making circuit tests.

5. Always stand on an ungrounded surface when using an oscilloscope.

6. Always connect the negative lead first when taking measurements with an oscilloscope.

OSCILLOSCOPE SAFETY QUIZ

NAME ______________________

CLASS ______________________

DATE ___________ GRADE_____

Read each statement carefully and record the best choice.

____ 1. When making circuit measurements with an oscilloscope:

A. do not touch the metal parts of the test leads.
B. always connect the positive lead first.
C. always connect the negative lead first.
D. do both A and C.

____ 2. When using an oscilloscope:

A. always stand on an ungrounded surface.
B. always stand on a grounded surface.
C. always work alone.
D. do both A and C.

____ 3. Do not use an oscilloscope until:

A. the cabinet has been checked for defects.
B. the power cord has been checked for defects.
C. the teacher has given proper instruction in its use.
D. both B and C have been done.

____ 4. Before servicing or repairing an oscilloscope:

A. see if the tube lights up.
B. disconnect the oscilloscope from the power source.
C. check the vertical hold.
D. do both A and B.

Key

1. D

2. A

3. D

3. B

POWER SUPPLY

1. Do not use a power supply until the teacher has given proper instruction in its use.
2. Disconnect the power supply from the circuit and power source before servicing or repairing it.
3. Examine the power cord for defects each time the power supply is used.
4. Set all power supply controls to "zero" or "off" before connecting to the power source.
5. Turn off the power supply before replacing fuses or resetting circuit breakers.
6. Always stand on an ungrounded surface when using a power supply.

POWER SUPPLY SAFETY QUIZ

NAME ______________________________

CLASS ____________________________

DATE _____________ GRADE ________

Read each statement carefully and record the best choice.

_____ 1. Disconnect the power supply from its power source before:

- A. adjusting the output.
- B. servicing or repairing it.
- C. replacing the fuses or resetting the circuit breakers.
- D. doing both B and C.

_____ 2. Do not use a power supply unless:

- A. the teacher has given proper instruction in its use.
- B. the output has been adjusted.
- C. the power cord has been examined for defects.
- D. both A and C have been done.

_____ 3. When using a power supply:

- A. always stand on an ungrounded surface.
- B. always stand on a grounded surface.
- C. always use uninsulated leads.
- D. do both B and C.

_____ 4. Before connecting the power supply to its power source:

- A. set all the controls to the correct reading.
- B. place the power source on a grounded surface.
- C. set all the controls to "zero" or "off."
- D. do both B and C.

Key

1. D   3. B

2. D   4. C

SIGNAL GENERATOR

1. Do not use a signal generator until the teacher has given proper instruction in its use.
2. Disconnect the signal generator from the circuit and power source before servicing or repairing it.
3. Examine the power cord for defects each time the signal generator is used.
4. Do not touch the metal parts of the test leads when making circuit tests.
5. Always stand on an ungrounded surface when using a signal generator.

SIGNAL GENERATOR SAFETY QUIZ

NAME ____________________

CLASS ____________________

DATE ___________ GRADE _____

Read each statement carefully and record the best choice.

_____ 1. Do not use a signal generator until:

- A. the teacher has given proper instruction in its use.
- B. the power cord has been examined for defects.
- C. it has been set for the proper frequency.
- D. both A and B have been done.

_____ 2. Disconnect the signal generator from the power source:

- A. before setting the frequency.
- B. before making any connections.
- C. before servicing or repairing it.
- D. before doing both A and C.

_____ 3. When connecting a signal generator into an electrical circuit:

- A. do not touch the metal parts of the leads.
- B. place it on a grounded surface.
- C. connect the positive lead first.
- D. do both A and B.

_____ 4. When using a signal generator:

- A. always stand on a grounded surface.
- B. always stand on an ungrounded surface.
- C. connect the positive lead first.
- D. do both B and C.

Key

1. D
2. C
3. A
4. B

SIGNAL TRACER

1. Do not use a signal tracer until the teacher has given proper instruction in its use.
2. Disconnect the signal tracer from the circuit and power source before servicing or repairing it.
3. Examine the power cord for defects each time the signal tracer is used.
4. Do not touch the metal parts of the test leads when making circuit tests.
5. Always stand on an ungrounded surface when using a signal tracer.
6. Always connect the negative lead first when taking measurements with a signal tracer.

SIGNAL TRACER SAFETY QUIZ

NAME ______________________

CLASS ______________________

DATE ____________ GRADE______

Read each statement carefully and record the best choice.

_____ 1. When making tests with a signal tracer:

A. always turn off the power source.
B. always connect the negative lead first.
C. always connect the positive lead first.
D. do both A and B.

_____ 2. When using a signal tracer:

A. always use uninsulated test leads.
B. always examine the power cord for defects.
C. stand on an ungrounded surface.
D. do both B and C.

_____ 3. Before servicing or repairing a signal tracer:

A. disconnect it from the circuit and power source.
B. turn the switch off.
C. place it on a grounded surface.
D. do both A and C.

_____ 4. For one's own protection, one should not:

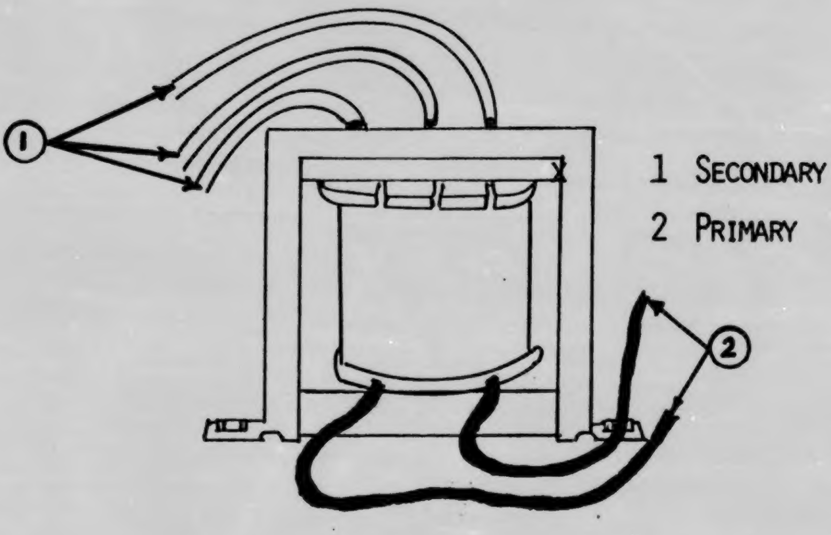
A. touch the metal parts of the test leads when making circuit tests.
B. use a signal tracer until the teacher has given proper instruction in its use.
C. use a signal tracer on an ungrounded surface.
D. do both A and B.

Key

1. B 3. A

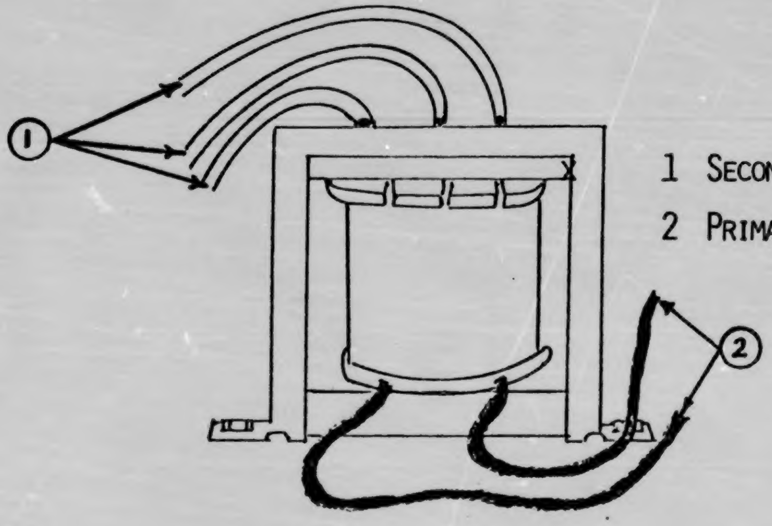
2. D 4. D

TRANSFORMER



1. Be sure the AC input line is connected to the primary side of the transformer.
2. Disconnect the transformer from the power source before servicing or repairing it.
3. Always stand on an ungrounded surface when using a transformer.

TRANSFORMER



1 SECONDARY

2 PRIMARY

TRANSFORMER SAFETY QUIZ

NAME ______________________

CLASS ______________________

DATE ____________ GRADE ____

Read each statement carefully and record the best choice.

_____ 1. Before servicing or repairing a transformer:

A. check which winding is the primary.
B. see if the transformer leads are color coded.
C. disconnect the transformer from the circuit.
D. do both A and B.

_____ 2. Before using a transformer:

A. be sure the leads are color coded.
B. be sure the AC input line is connected to the primary side of the transformer.
C. be sure one is standing on an ungrounded surface.
D. do both B and C.

Key

1. C

2. D

VOLTMETER

1. Disconnect the voltmeter from the circuit before servicing or repairing it.
2. Do not use a voltmeter until the teacher has provided proper instruction in its use.
3. Unplug the circuit from the power source before changing meter leads.
4. Use a voltmeter only on an ungrounded surface.
5. Always stand on an ungrounded surface when using a voltmeter.

VOLTMETER SAFETY QUIZ

NAME ______________________________

CLASS ____________________________

DATE ______________ GRADE ______

Read each statement carefully and record the best choice.

____ 1. Before servicing or repairing a voltmeter:

- A. place the meter on a grounded surface.
- B. make sure the meter is clean.
- C. disconnect the meter from the circuit.
- D. do both A and C.

_____2. When using a voltmeter:

- A. connect the voltmeter in a series with the power source.
- B. stand on an ungrounded surface.
- C. use only uninsultated meter leads.
- D. do both A and B.

_____3. When connecting a voltmeter into an active circuit:

- A. use only uninsulated meter leads.
- B. unplug the circuit from the power source.
- C. place the meter on an ungrounded surface.
- D. do both B and C.

Key

1. C
2. D
3. B

GRAPHIC ARTS EQUIPMENT

(LETTERPRESS COMPOSITION)

HAND TYPESETTING

1. Stand when setting type.
2. Do not force type into the composing stick. It can cut the thumb.
3. Do not throw type. Flying type can cause injury to others, can damage the metal, and is a sign of a poor worker.
4. Get help instead of risking injury when carrying heavy type cases. Lift with the knees, not the back.
5. Grip the type case and other apparatus properly and securely when carrying in order to avoid dropping and causing foot injuries.
6. Avoid running the fingers or hand over edges of lead, brass, or steel rules to test or clean them. Do not run the fingers over perforating or cutting rules. Sharp edges will cut the fingers.
7. Keep hands away from mouth and eyes when working with lead or ink; both are poison.
8. Clean type cases with vacuum. Do not use one's breath or compressed air.
9. Pick up type or other objects which fall on the floor. Small items can cause one to slip and fall.

MAKE-UP, STONEWORK, AND IMPOSITION

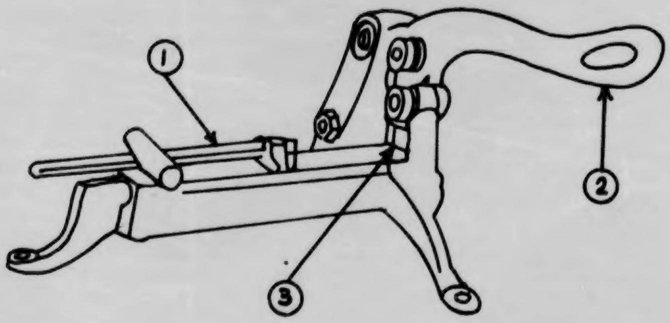
1. Handle ruled forms with care to avoid cuts. Deep, painful wounds may be caused by running one's fingers over rule edges.
2. Keep the hands away from the mouth and eyes.
3. Keep the make-up area clear of those items which might cause tripping.

4. Get help to lift heavy forms. Bend the knees and lift with them, not with the back.

5. When finished with a chase, always place it carefully in the storage rack, so that others will not upset it.

6. Tighten forms properly. Over-tightening may cause a wedge to buckle or the chase to snap, thus injuring the hands or face.

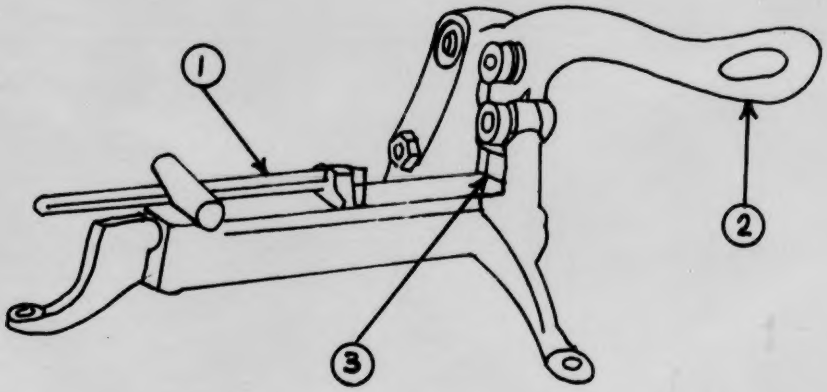
LEAD AND RULE CUTTER
HAND MITER MACHINE



1. LENGTH GAUGE
2. HANDLE
3. KNIFE

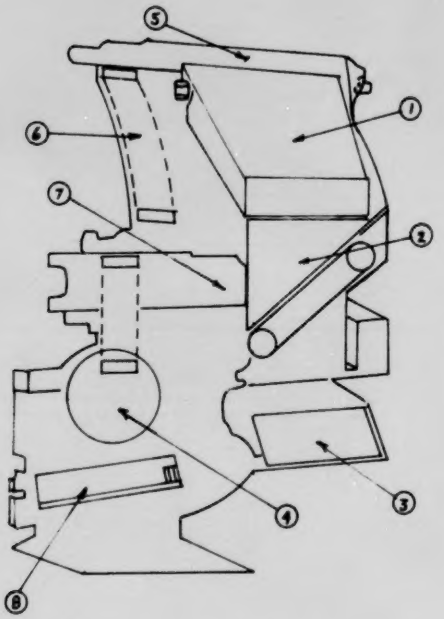
1. Operate only with the teacher's permission and after instructions have been received.
2. Never place the fingers on the cutting edges.
3. Be sure the fingers are clear of the moving parts when the cutter is in use.
4. Be especially careful when cutting small sizes.

LEAD AND RULE CUTTER
HAND MITER MACHINE



1 LENGTH GAUGE
2 HANDLE
3 KNIFE

LINOTYPE



1. MAGAZINE
2. DELIVERING CHANNELS
3. KEY BOARD
4. CASTING MECHANISM
5. DISTRIBUTOR
6. DISTRIBUTING ELEVATOR
7. SPACE BOX
8. GALLEY

Hot Type Composition

1. Operate only with the teacher's permission and after instructions have been received.

2. Tell the teacher about any defects. Do not attempt to make repairs.

3. Never remove a guard. It is placed on the machine to protect the operator.

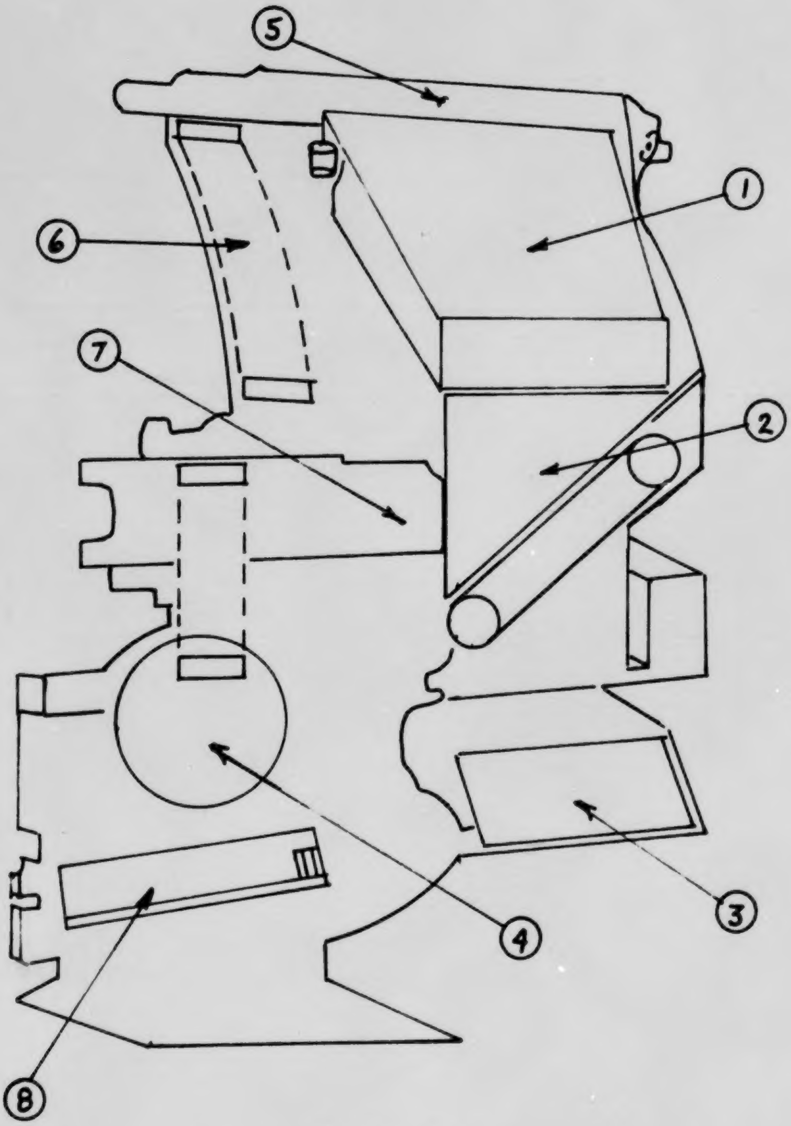
4. If hot metal squirts, do not attempt to shut off the machine. Get out of the way and call the teacher.

5. Never hold the pump-stop lever open to cast a line. If the machine casts, squirts could cause dangerous burns.

6. Overfilling the metal pot may cause the heating element to overheat, thus creating a fire hazard.

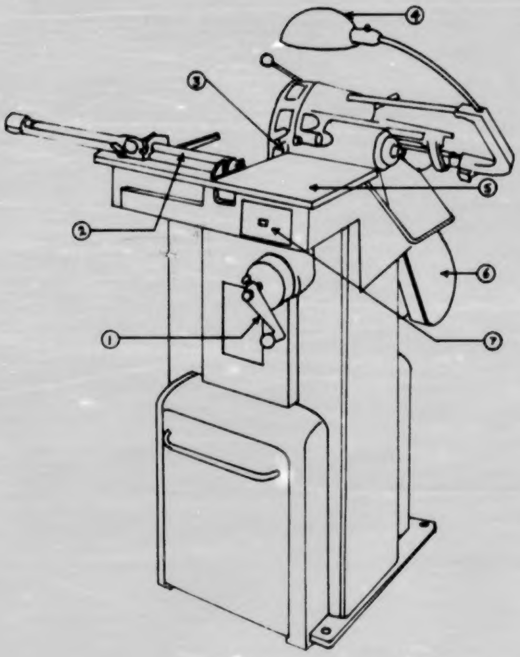
7. Use caution when lifting magazines and pigs of metal. Use the knees, not the back, when lifting.

LINOTYPE



1 MAGAZINE	5 DISTRIBUTOR
2 DELIVERING CHANNELS	6 DISTRIBUTING ELEVATOR
3 KEYBOARD	7 SPACE BOX
4 CASTING MECHANISM	8 GALLEY

COMPOSING ROOM SAW



1. BLADE HEIGHT CONTROL
2. SLUG CLAMP
3. BLADE
4. WORK LIGHT
5. SAW TABLE
6. MOTOR GUARD
7. POWER SWITCH

1. Operate only with the teacher's permission, and after instructions have been received.

2. Wear safety goggles to protect the eyes from flying metal chips.

3. Clamp the type and slugs securely in the saw clamp before cutting.

4. Never use the saw without having the blade guard in place.

5. Keep one's fingers away from the blade at all times.

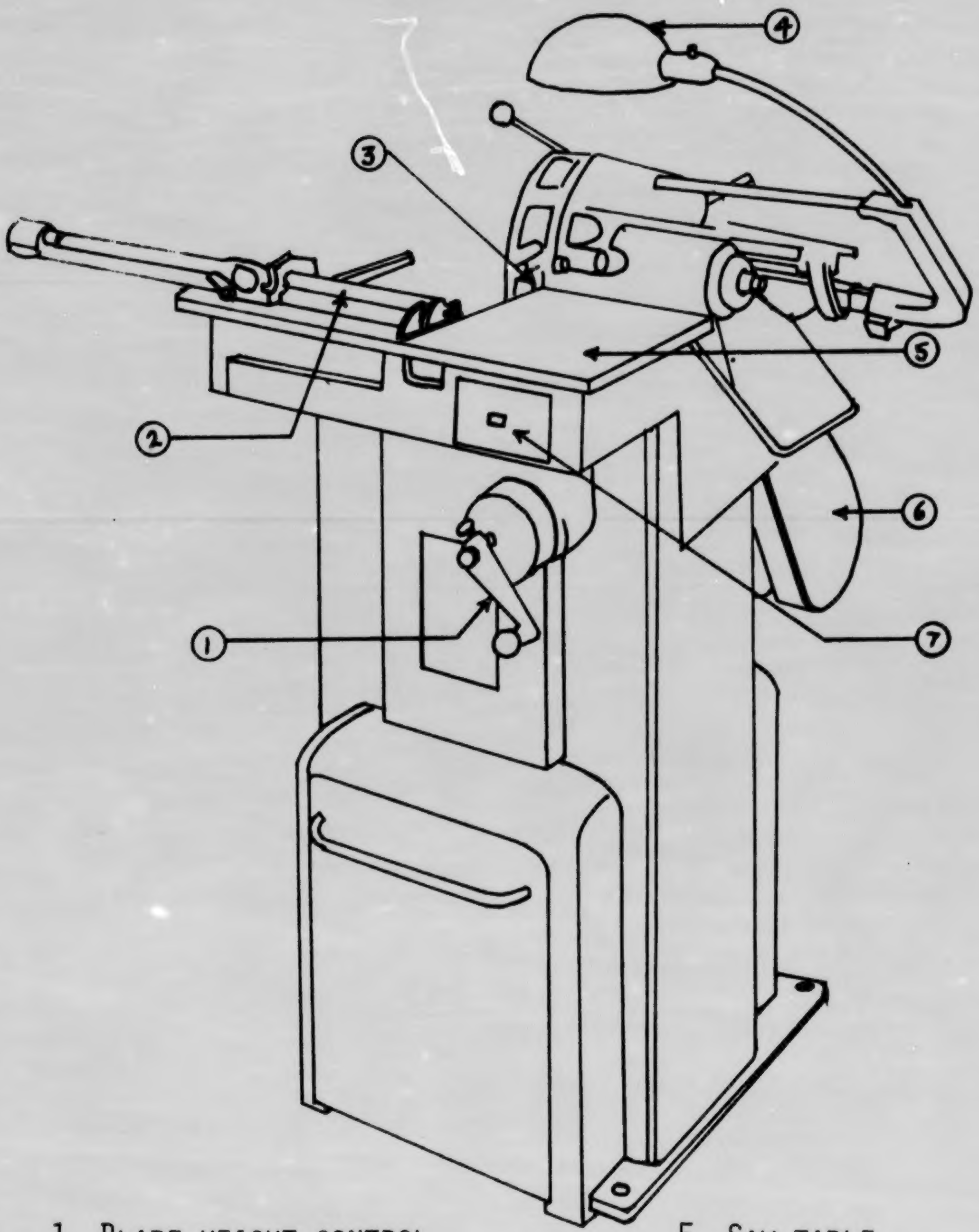
6. When the blade becomes dull, replace it with a sharp one.

7. Be sure that there is only one operator at the saw. No one else should be in the safety zone.

8. Never stand directly behind the blade.

9. When one has finished using the composing room saw, he/she should turn it off and wait for the blade to come to a complete stop before leaving it.

COMPOSING ROOM SAW



1 BLADE HEIGHT CONTROL
2 SLUG CLAMP
3 BLADE
4 WORK LIGHT

5 SAW TABLE
6 MOTOR GUARD
7 POWER SWITCH

LETTERPRESS COMPOSITION SAFETY QUIZ

NAME ______________________________

CLASS ______________________________

DATE ___________________ GRADE _____

True-False:

T F 1. Fingers and hands must be kept away from the face when type is handled.

T F 2. Running the hands over perforating or cutting rules should be avoided.

T F 3. It is best for one person alone to handle very heavy type cases because his/her control will be better.

T F 4. Type should be forced into composing sticks with the thumb if it does not slide freely into place.

T F 5. Over-filling the metal pot may cause the heating element to overheat, thus creating a fire hazard.

T F 6. The pump-stop lever should never be held open to cast a line.

T F 7. Guards should be removed whenever they appear to be in the way or are not really necessary.

T F 8. The plunger pin should be removed if the machine stalls just before casting a line in order to prevent a double squirt.

T F 9. A pupil may set type when standing or sitting, whichever is most convenient.

T F 10. The fingers should be kept clear of the mitering machine blade.

T F 11. Forms must be tightened as securely as possible so the lead won't fall out on the feet.

T F 12. A finger may be run over the rule to check for sharp edges.

Multiple Choice:

_____ 13. As a protection against the knife action of the lead and rule cutter, one should: (a) operate the cutter as fast as possible, (b) keep fingers clear of the moving parts, (c) cut the rules with a hack saw, (d) place a wedge in the cutter to stop the knife action.

_____ 14. If the Linotype or Ludlow machine needs adjustment: (a) make adjustment needed, if possible, (b) get another pupil to help make the adjustment, (c) tell the teacher and let him/her decide what adjustment needs to be made, (d) none of these.

_____ 15. When finished with a chase: (a) return it to the proper storage place, (b) leave it out for someone else to use, (c) put it in the corner until clean-up time, (d) ask a friend if he needs it.

_____ 16. When lifting heavy items: (a) get someone to help, if necessary, (b) show strength by doing it alone, (c) lift with the legs, not the back, (d) do both a and c.

_____ 17. Type cases may best be cleaned by: (a) using compressed air, (b) blowing on them, (c) using a vacuum, (d) a combination of b and c.

_____ 18. It is all right to throw a piece of type to someone: (a) if one has good aim, (b) if no one is in the way, (c) if the teacher isn't looking, (d) never.

_____ 19. When using the lead and rule cutter or mitering machine, be especially careful when cutting: (a) small sizes, (b) large sizes, (c) mixed sizes, (d) none of these.

_____ 20. Throwing type is not allowed because : (a) thrown type may injure someone's eyes, (b) the teacher may be hit, (c) lights or windows might be broken, (d) type thrown and lost may be needed by another pupil.

_____ 21. Use the composing room saw: (a) anytime the teacher is in the room, (b) only after receiving the teacher's permission, (c) any time it is necessary, (c) anytime the teacher is out of the room.

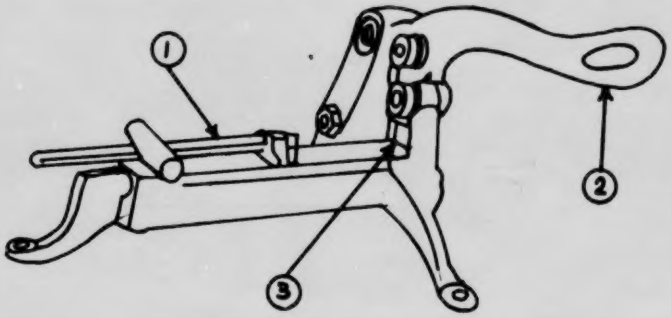
_____ 22. When operating the composing room saw, be sure: (a) to keep the fingers away from the blade, (b) the blade guard is in place, (c) to clamp items securely, (d) to do all of these.

____ 23. After using the composing room saw: (a) turn off the power and wait for the blade to come to a complete stop, (b) leave as soon as the "off" switch is flipped, (c) ask if anyone else needs to use it, (d) do none of these.

____ 24. During the operation of the cutting room saw, the following persons may be involved: (a) the operator only, (b) the operator plus one assistant, (c) the operator, assistant, and one observer, (d) anyone at all.

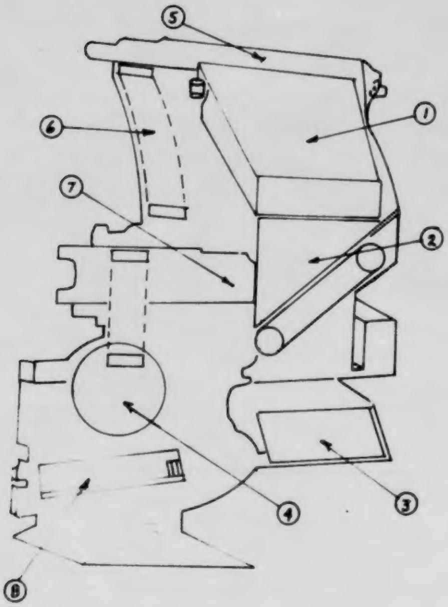
25. Write the correct name of each machine and its parts in the space provided.

A. ____________________

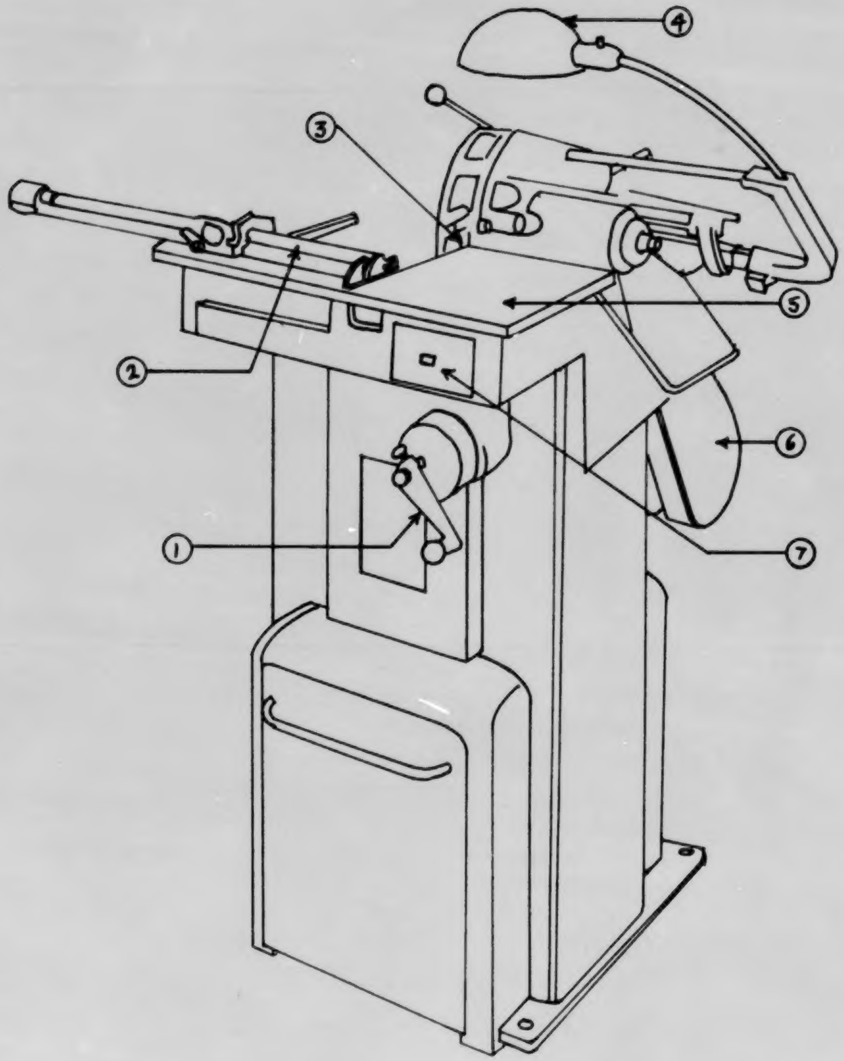


1. ____________________
2. ____________________
3. ____________________

B. ____________________



1. ____________________
2. ____________________
3. ____________________
4. ____________________
5. ____________________
6. ____________________
7. ____________________
8. ____________________



C. ______________________________

1. ____________________

2. ____________________

3. ____________________

4. ____________________

5. ____________________

6. ____________________

7. ____________________

KEY

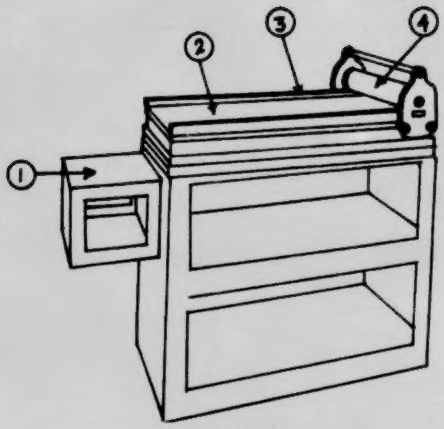
1. T
2. T
3. F
4. F
5. T
6. T
7. F
8. F
9. F
10. T
11. T
12. F
13. B
14. C
15. A
16. D
17. C
18. D
19. A
20. A
21. B
22. D
23. A
24. A

25A. Lead and Rule Cutter
   1. Length gauge
   2. Handle
   3. Knife

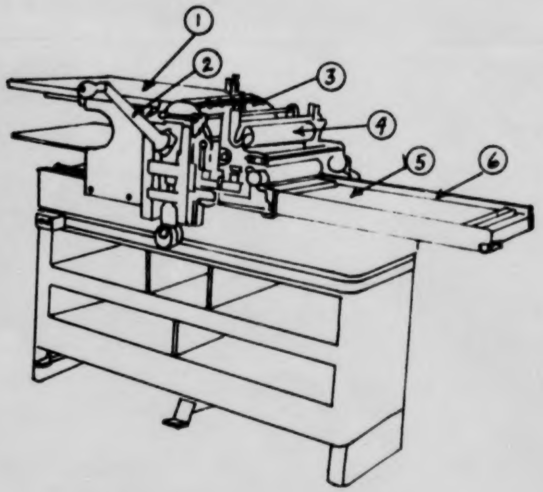
B. Linotype
   1. Magazine
   2. Delivering channels
   3. Keyboard
   4. Casting mechanism
   5. Distributor
   6. Distributing elevator
   7. Space box
   8. Galley

C. Composing Room Saw
   1. Blade height control
   2. Slug clamp
   3. Blade
   4. Work light
   5. Saw table
   6. Motor guard
   7. Power switch

PROOF PRESSES



1. INK DISK
2. BED
3. TRACK
4. IMPRESSION CYLINDER



1. FEED BOARD
2. HANDLE
3. PAPER CYLINDERS
4. INK ROLLERS
5. BED
6. TRUCK

1. Operate only with the teacher's permission and after instructions have been received.

2. Be sure that only one student operates the proof press at any one time.

3. Keep hands off the track.

4. Leave the handle in an upright position when it's not in use.

5. Clean type after proofing.

6. After the type is cleaned, return the cleaning rags to the fireproof metal rag container and leave the area clean.

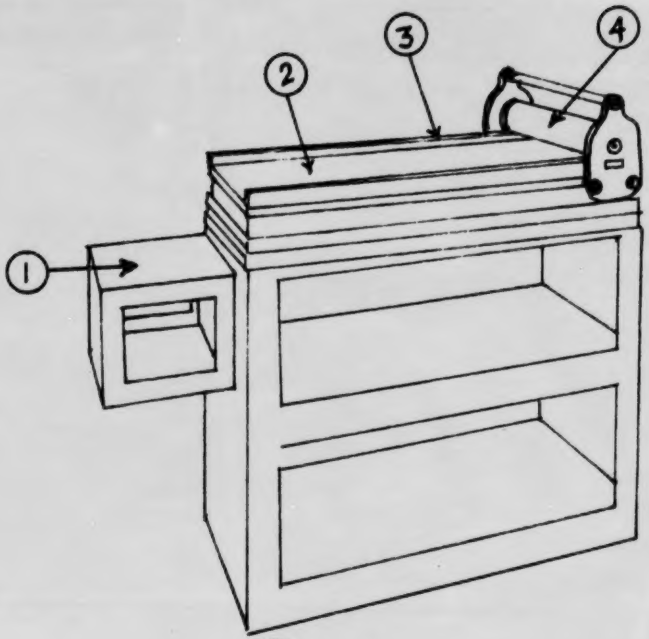
7. Treat type cleaner with care. It is flammable, poisonous, and hard on the skin.

8. Before using the proof press, secure loose clothing and long hair to prevent its being pulled into the press.

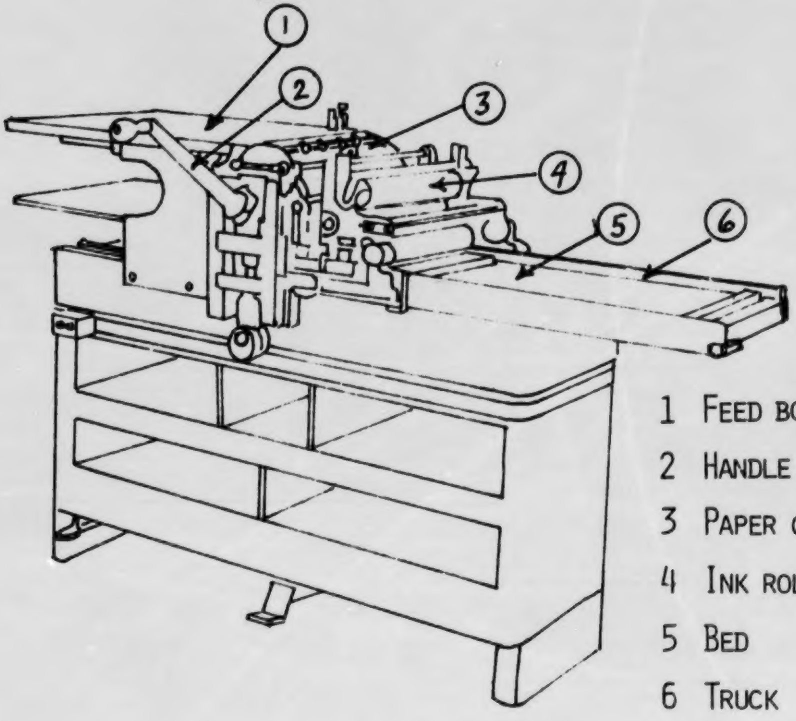
9. Do not use tweezers with an attached bodkin. Bodkins are sharp and can cause injury.

10. Pick up type of other objects which fall on the floor. Small items can cause one to slip and fall.

PROOF PRESSES



1 Ink disk
2 Bed
3 Track
4 Impression cylinder



1 Feed board
2 Handle
3 Paper cylinder
4 Ink rollers
5 Bed
6 Truck

PROOF PRESSES SAFETY QUIZ

NAME ______________________________

CLASS ______________________________

DATE _____________ GRADE __________

True-False:

T F 1. Type cleaner is both flammable and poisonous.

T F 2. If any type falls on the floor while one is using the proof press, leave it there until the work is finished, then pick it up.

T F 3. Loose clothing doesn't need to be tucked in before using the proof press because the press will not catch clothing.

Multiple Choice:

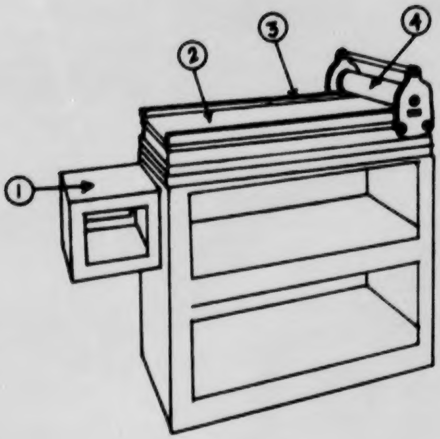
_____ 4. When not in use, the handle of the proof press should be left: (a) upright, (b) down, (c) down and locked, (d) any way at all.

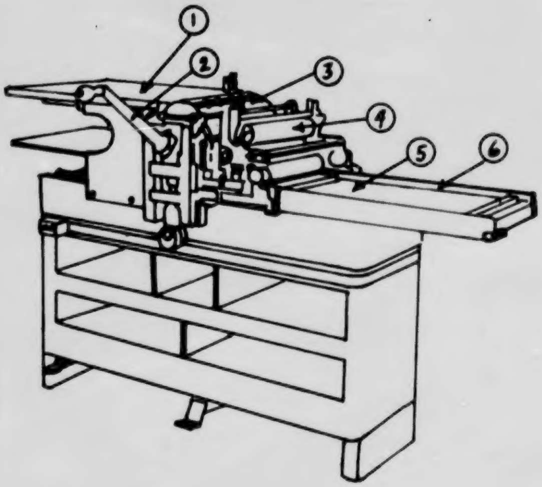
_____ 5. After cleaning type, dirty rags should be: (a) rolled in a tight bundle, (b) thrown in a wastebasket, (c) placed in a covered metal container, (d) left on the press for the next person to use.

_____ 6. During the operation of the proof press, the following persons may be involved: (a) one person only, (b) the operator plus a helper chosen by the operator, (c) the operator, helper, and one other pupil observer, (d) any number of people, as long as they don't distract the operator.

_____ 7. When using the proof press, the pupil should protect his/her hands by: (a) handling the brayer correctly, (b) moving the roller quickly, (c) asking another pupil to operate the roller, (d) keeping them clear of the ends of the press and the track.

8. Write the correct name of the machines and each part in the spaces provided.





A. ______________________________

1. ______________________
2. ______________________
3. ______________________
4. ______________________

1. ______________________
2. ______________________
3. ______________________
4. ______________________
5. ______________________
6. ______________________

KEY

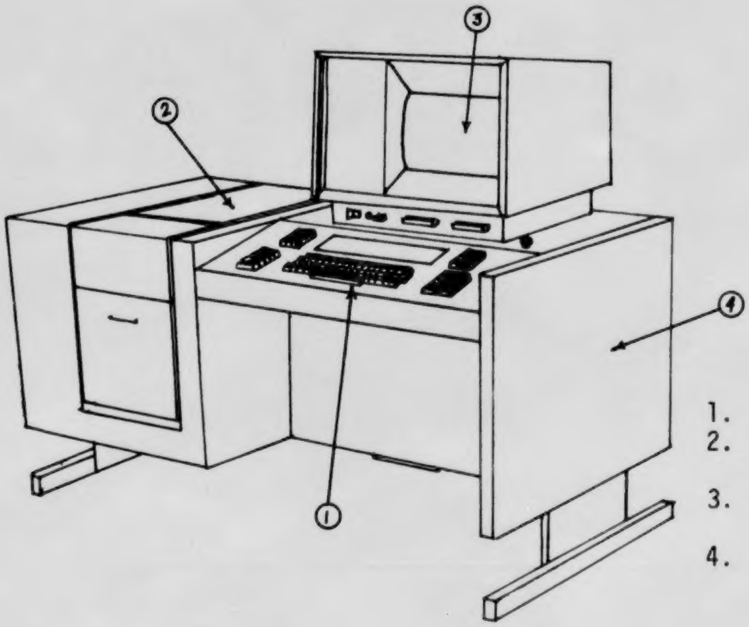
1. T
2. F
3. F
4. A
5. C
6. A
7. D

8A. Proof presses
    1. Ink disk
    2. Bed
    3. Track
    4. Impression cylinder

    1. Feed board
    2. Handle
    3. Paper cylinder
    4. Ink rollers
    5. Bed
    6. Truck

OFFSET COMPOSITION

Phototypesetter/Composer



1. KEYBOARD
2. PHOTOTYPESETTING UNIT
3. TYPE COMPOSING SCREEN
4. MACHINE ELECTRONICS (INSIDE)

1. Operate the composer only after the proper instruction and after receiving the teacher's permission.

2. Advise the teacher of any machine malfunction; do not attempt repairs.

3. Do not remove the protective cover of a composing machine and reach inside. These machines may have high voltage circuits inside them.

4. Use extreme care when handling type fonts as dropping them will cause breakage or scratching.

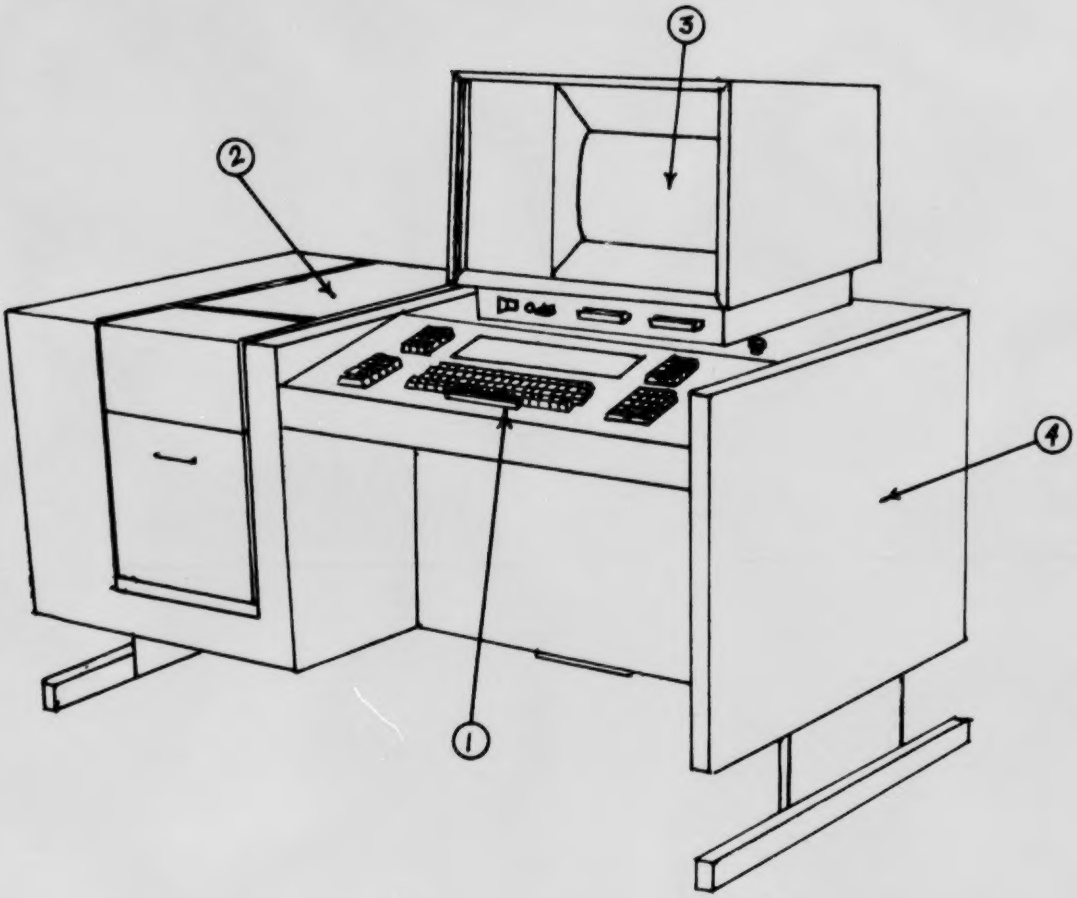
5. When mixing chemicals for the machine processor, avoid skin contact. Wear safety glasses to prevent splashing chemicals in the eyes.

6. Always wash the hands after processing photo paper.

7. Avoid inhaling chemical dust or fumes when working with processing chemicals.

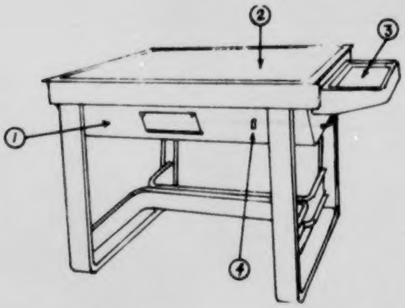
8. Unplug the machine before reaching into it to clear up any paper jams.

PHOTOTYPESETTER



1 Keyboard	3 Type composing screen
2 Photosetting unit	4 Machine electronics (inside)

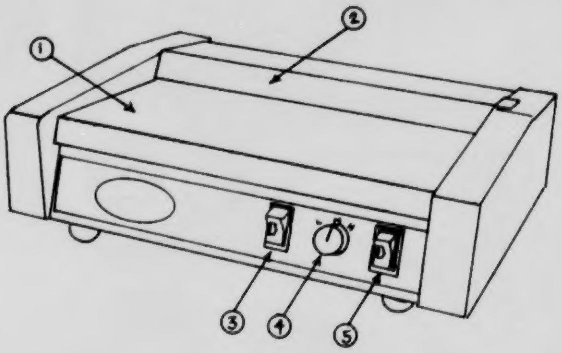
Light or Stripping Table



1. LIGHT HOUSING
2. GLASS TOP
3. STORAGE SHELF
4. LIGHT SWITCH

1. Keep all foreign material off the glass so it will not be broken.
2. Keep fingers out of the cutting area when cutting a flat.
3. Store the cutting tools, X-acto knives, and razor blades properly and keep them sharp.
4. Do not lean, sit, or drop anything on a glass-top light table. Use extreme care when cleaning it.

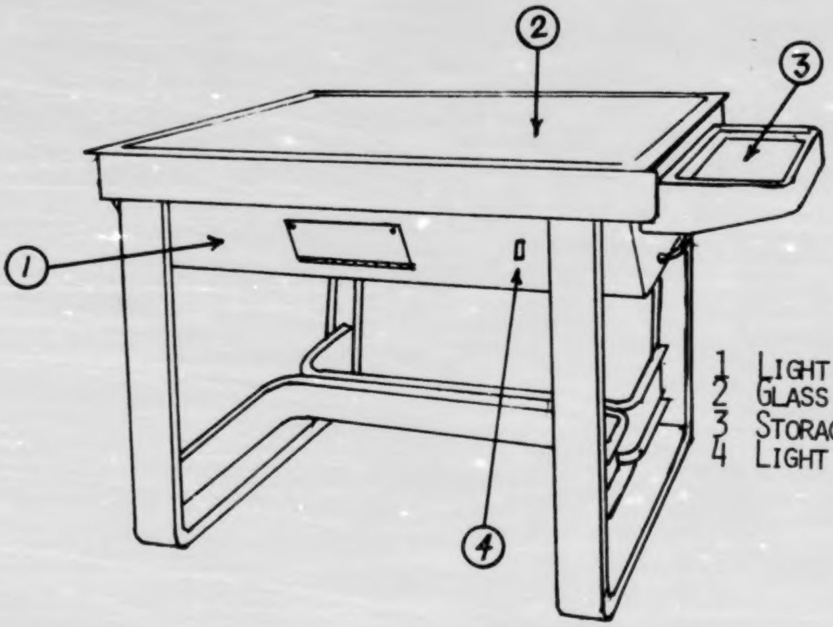
Adhesive Wax Coater



1. WAX TRAY COVER
2. WAX ROLLER UNDER GUARD
3. POWER SWITCH
4. THERMOSTAT
5. WAX ROLLER SWITCH

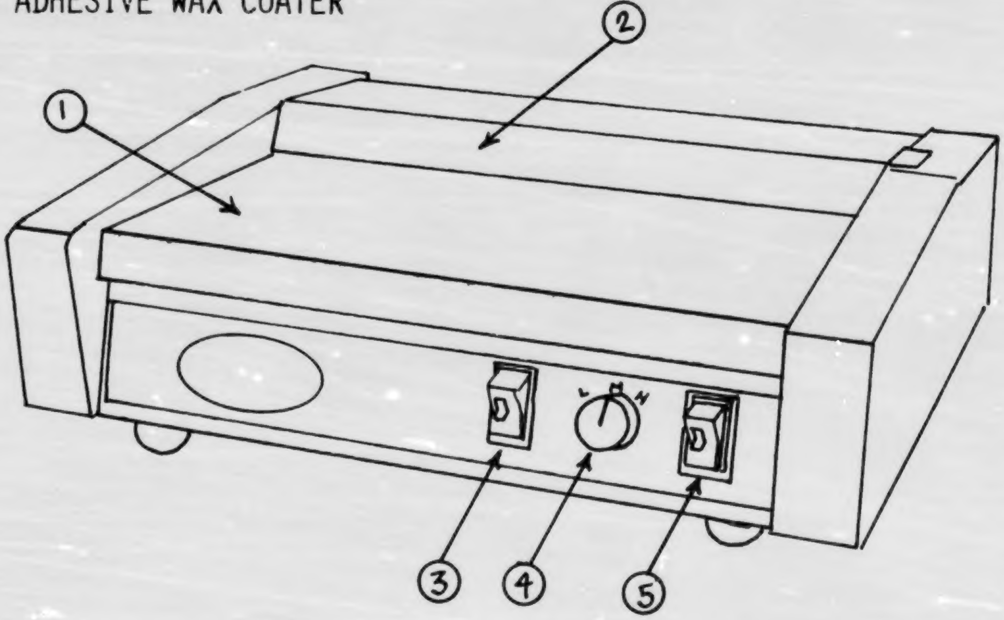
1. Cover rubber cememt cans after using them. Avoid breathing the fumes as they may be hazardous to one's health.
2. Treat rubber cement carefully. It is flammable.
3. To avoid burns, be careful not to touch the hot parts of a waxer. Do not move the waxer as this may cause spilling of the hot wax.
4. Always add wax to the waxer before turning it on.

LIGHT OR STRIPPING TABLE



1 LIGHT HOUSING
2 GLASS TOP
3 STORAGE SHELF
4 LIGHT SWITCH

ADHESIVE WAX COATER



1 WAX TRAY COVER
2 WAX ROLLER UNDER GUARD
3 POWER SWITCH
4 THERMOSTAT
5 WAX ROLLER SWITCH

OFFSET COMPOSITION SAFETY QUIZ

NAME ______________________________

CLASS ______________________________

DATE ________________ GRADE ________

True-False:

T F 1. Chemicals for the machine processor are not dangerous so no special precaution needs to be taken when using them.

T F 2. The composer should be unplugged before reaching into it to clear up paper jams.

T F 3. It is safe to lean or sit on light tables and stripping tables because they have unbreakable glass tops.

T F 4. It is safer to use a dull cutting tool than a sharp one.

T F 5. Rubber cememt cans must be covered after each use, and a person should not breathe the fumes.

T F 6. Hands should be washed after processing photo paper.

Multiple Choice:

_____ 7. If the composer malfunctions, do not attempt repairs unless: (a) the teacher gives permission, (b) one knows what one is doing, (c) another pupil helps you, (d) a project deadline must be met.

_____ 8. Cutting tools, X-acto knives, and razor blades should never be: (a) dull, (b) carried in the pocket, (c) left on the light table after use, (d) all of these.

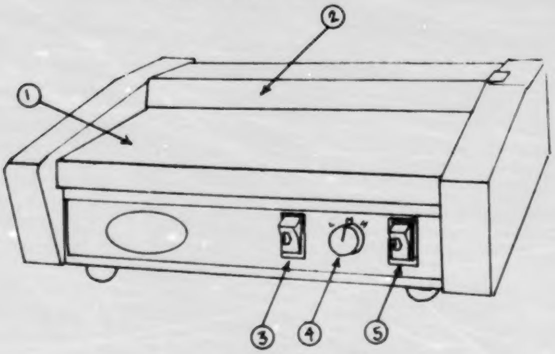
_____ 9. When mixing chemicals for the composer processor: (a) avoid skin contact, (b) wear safety glasses, (c) avoid inhaling fumes, (d) do all of these.

_____ 10. Add wax to the waxer: (a) before turning it on, (b) after the machine warms up, (c) anytime it is needed, (d) none of these.

_____ 11. To avoid burns: (a) be very careful when using the waxer, (b) do not move the waxer unless the wax is cool, (c) both of these, (d) neither a nor b--melted wax is not hot enough to burn a person.

____ 12. Rubber cement is flammable; therefore, it should be: (a) stored in fireproof containers, (b) used only in well-ventilated areas, (c) kept away from flames and sparks, (d) all of these.

13. Write the correct name of each machine and its parts in the space provided.



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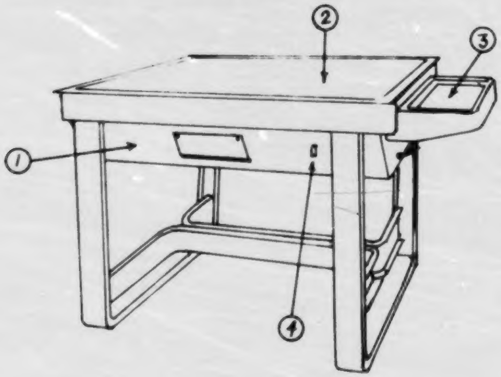

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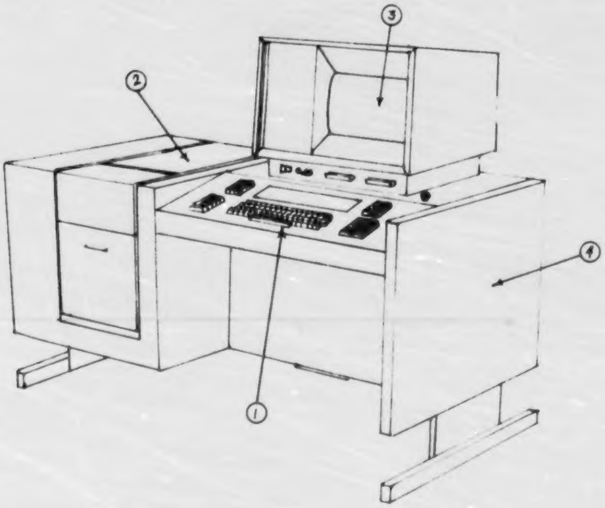

C. ____________________

1. ____________________

2. ____________________

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4. ____________________

KEY

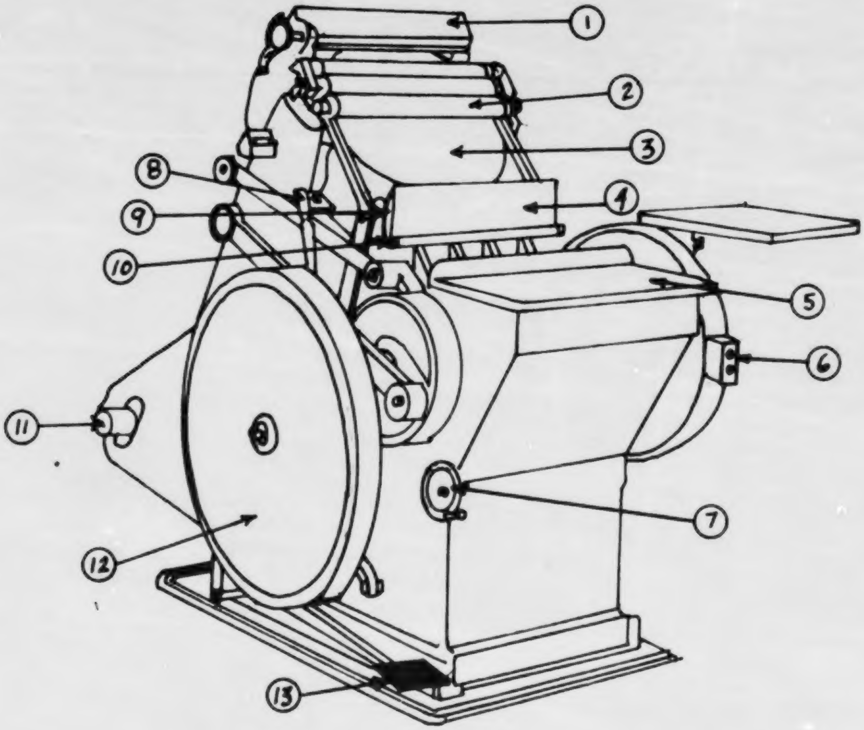
1. F
2. T
3. F
4. F
5. T
6. T
7. A
8. D
9. D
10. A
11. C
12. D

13A. Adhesive Wax Coater
   1. Wax tray cover
   2. Wax roller under guard
   3. Power switch
   4. Thermostat
   5. Wax roller switch

B. Light Table
   1. Light housing
   2. Glass top
   3. Storage shelf
   4. Light switch

C. Phototypesetter
   1. Keyboard
   2. Phototypesetting unit
   3. Type composing screen
   4. Machine electronics (inside)

PLATEN PRESS



1. INK FOUNTAIN
2. INK ROLLERS
3. INK DISK
4. PLATEN GUARD
5. DELIVERY BOARD
6. POWER SWITCH
7. SPEED CONTROL
8. IMPRESSION LEVER
9. CHASE BED
10. PLATEN
11. MOTOR
12. FLY WHEEL
13. BRAKE

1. Operate only with the teacher's permission and after instructions have been received.

2. Make no adjustments while the machine is running.

3. Oil press only when the power is turned off and the machine is at a dead stop.

4. Apply ink to the disk only when the press is at a dead stop.

5. Remove hands at once when the press begins to close--even if the paper is not in straight. Use the throw-off lever.

6. Never reach into or below the press while it is running.

7. Use the foot brake and turn off the switch if an emergency occurs.

8. Do not talk to a pupil while he/she is operating a machine. This tends to distract his/her attention from the work and may contribute to an accident.

9. Do not operate machines while the teacher is out of the room.

10. Never allow sleeves and ties to hang loosely while operating the press. Aprons should also be securely fastened, and extreme care must be taken so that they do not come in contact with moving parts.

11. Be certain the form is locked securely in the bed.

12. Make sure no one else is inside the operator's zone.

13. Gauge the speed of the press according to one's ability to feed it.

14. Keep flammable solvents in fireproof containers and store oily or dirty rags in proper containers.

15. Use care in opening ink cans.

16. Do not lift heavy forms alone. Get help if it's needed.

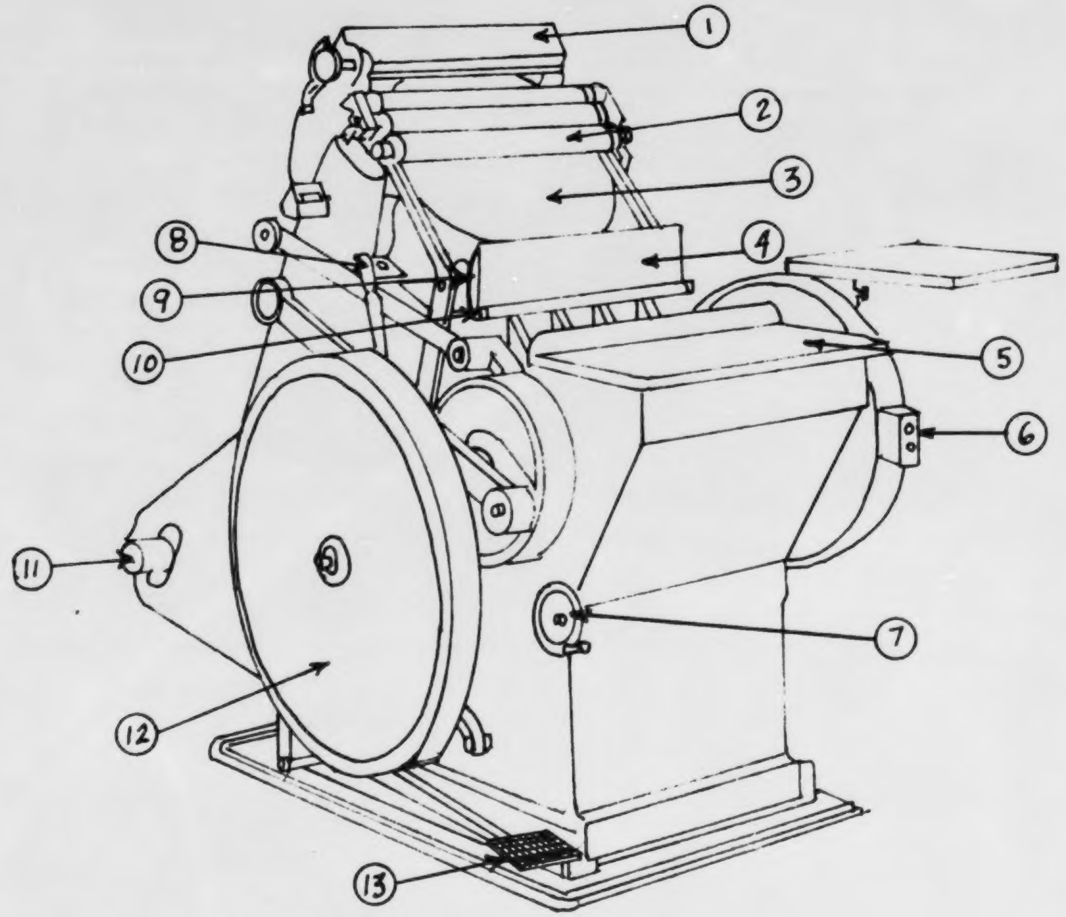
17. Store heavy forms so they will not fall on someone's feet.

18. Avoid paper cuts by using care in handling.

19. Supply all roller-type printing machines with nip guards. (UOSHA)

PLATEN PRESS

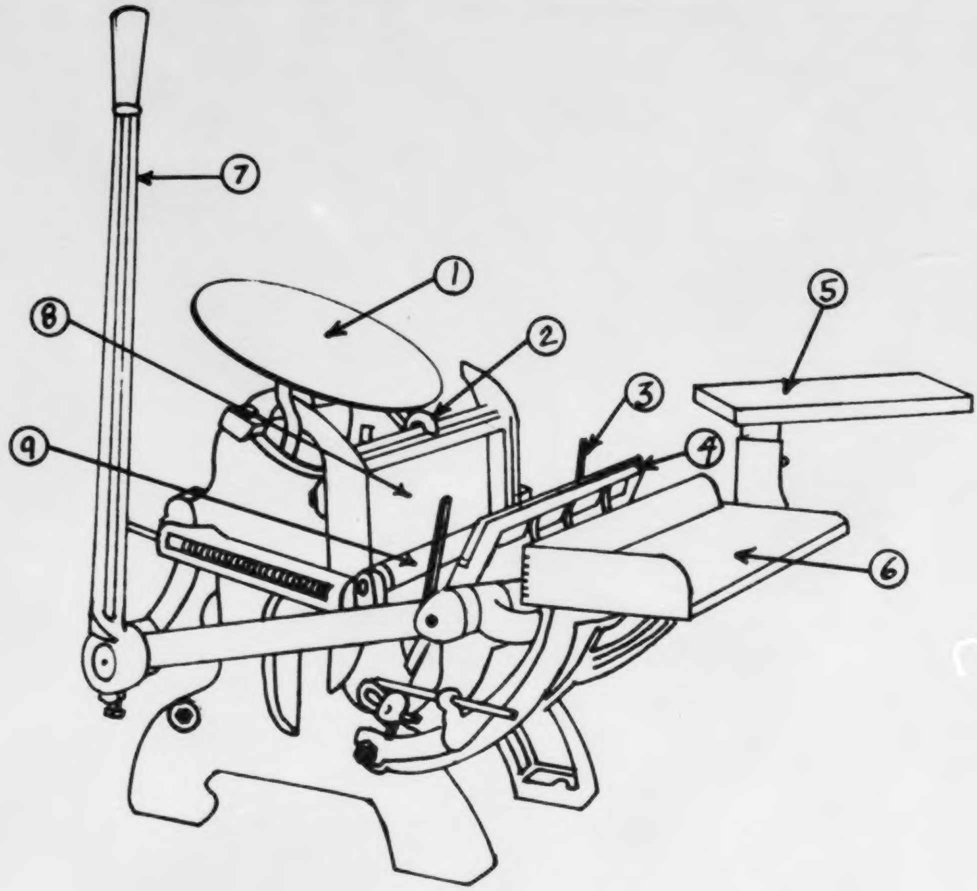
(POWER-OPERATED)



1	INK FOUNTAIN	8	IMPRESSION LEVER
2	INK ROLLERS	9	CHASE BED
3	INK DISK	10	PLATEN
4	PLATEN GUARD	11	MOTOR
5	DELIVERY BOARD	12	FLY WHEEL
6	POWER SWITCH	13	BRAKE
7	SPEED CONTROL		

PLATEN PRESS

(HAND LEVER-OPERATED)



1	INK DISK	6	DELIVERY BOARD
2	TOP CHASE CLAMP	7	HAND OPERATING LEVER
3	GRIPPER	8	BED
4	PLATEN	9	INK ROLLER
5	FEED BOARD		

PLATEN PRESS SAFETY QUIZ

NAME ______________________________

CLASS ______________________________

DATE _______________ GRADE ________

True-False:

T F 1. It is important to avoid talking to others when feeding the press.

T F 2. It is safe to reach into or below the press if it is running slowly.

T F 3. One should never work near a press with loose or dangling clothing.

T F 4. Oily rags used for cleaning the press should be thrown in the wastebasket.

Multiple Choice:

_____ 5. The press should be oiled only when: (a) the power is off and the machine is at a dead stop, (b) the machine is running slowly, (c) it is noisy, (d) the ink rollers pass across the delivery board.

_____ 6. It is best to ink the disk when the press is: (a) operating slowly, (b) operating fast, (c) at a dead stop, (d) coasting.

_____ 7. The speed of the press should be decided by: (a) the amount of work to be done, (b) the amount of time needed to do the work, (c) the rate of the previous operator, (d) the present operator's ability to feed the press.

_____ 8. Talking to someone operating the press is all right: (a) only when pertaining to shop problems, (b) when the teacher is in the shop, (c) if one is shop foreman, (d) never.

_____ 9. Use the platen press: (a) anytime the teacher is in the shop, (b) only after receiving the teacher's permission, (c) anytime one needs to, (d) after watching others and learning how to operate it.

_____ 10. If it is necessary to leave the press for only a moment: (a) it is safe to leave the machine running, (b) ask another pupil to operate it temporarily, (c) turn off the power and wait for the press to come to a complete stop, (d) leave it as soon as the switch has been flipped to the "off" position.

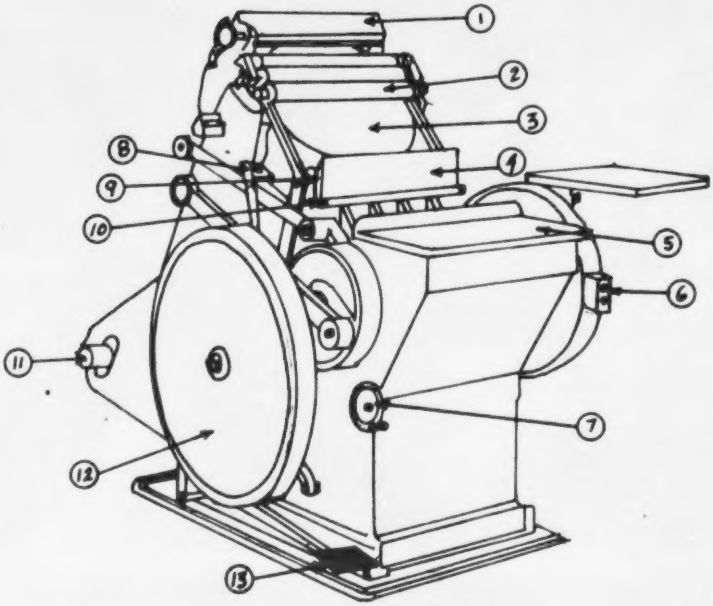
_____ 11. If the type forms are quite heavy: (a) get someone to help, (b) show one's independence by lifting it alone, (c) take a chance that it won't be dropped, (d) do none of these.

_____ 12. Before adjusting misfed stock: (a) use the throw-off lever and wait for the platen to stop, (b) slow the machine down, then reach in quickly and adjust it, (c) reach in quickly when the platen opens, (d) do none of these.

_____ 13. Handle paper by the edges whenever possible: (a) to keep it clean, (b) to avoid paper cuts, (c) because it's easier, (d) none of these.

14. Write the correct name of each machine and its parts in the space provided.

A. ______________________________



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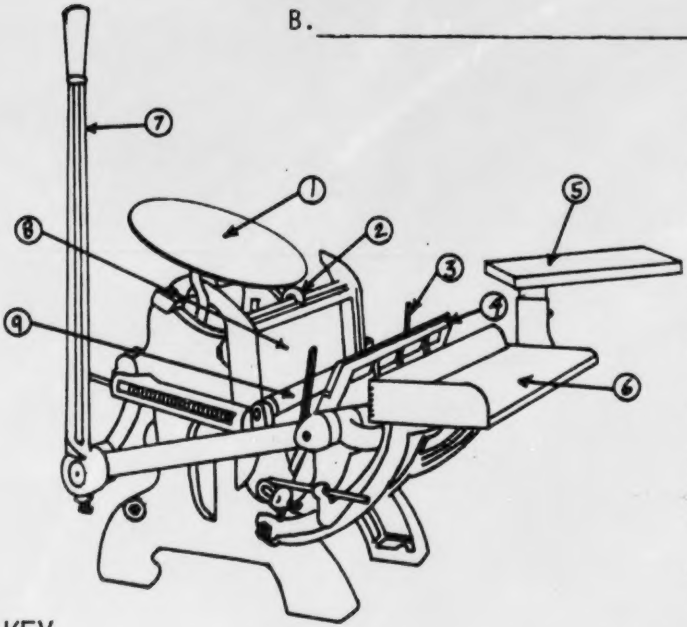
B. ________________________________



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9. ____________________

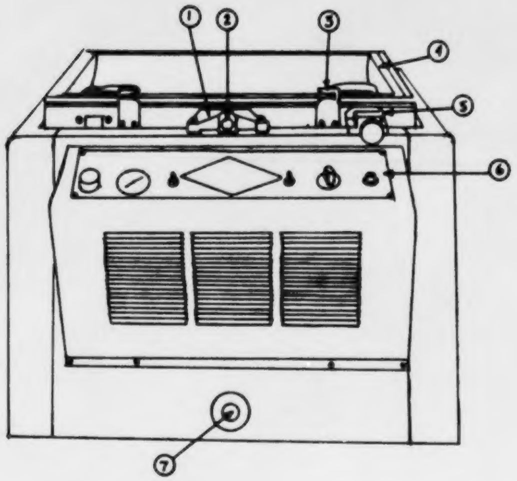
KEY

1. T
2. F
3. T
4. F
5. A
6. C
7. D
8. D
9. B
10. C
11. A
12. A
13. A

14A. Power-operated platen press
1. Ink fountain
2. Ink rollers
3. Ink disk
4. Platen guard
5. Delivery board
6. Power switch
7. Speed control
8. Impression lever
9. Chase bed
10. Platen
11. Motor
12. Flywheel
13. Brake

B. Hand-operated platen press
1. Ink disk
2. Top chase clamp
3. Gripper
4. Platen
5. Feed board
6. Delivery board
7. Hand operating lever
8. Bed
9. Ink roller

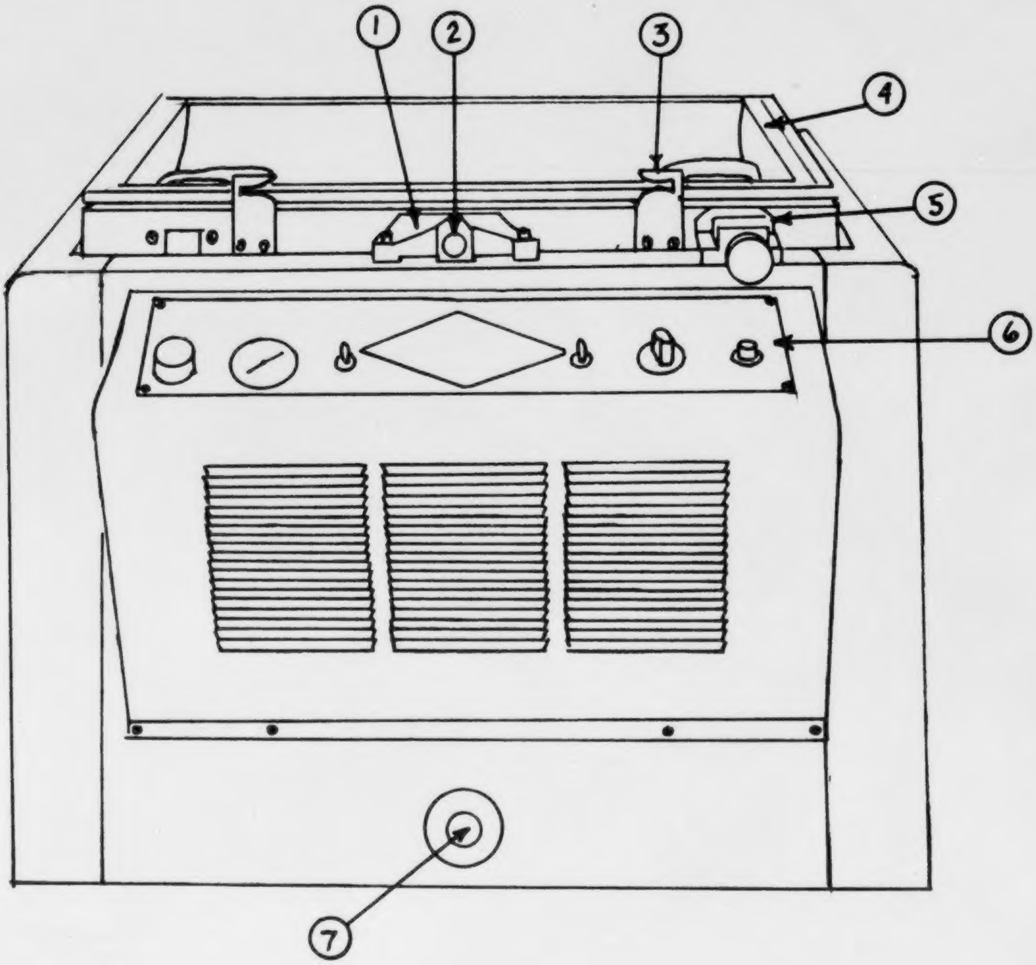
PLATEMAKER



1. AXLE BEARING
2. AXLE
3. GLASS FRAME LATCH
4. VACUUM FRAME ASSEMBLY
5. VACUUM FRAME LATCH
6. CONTROL PANEL
7. ARC CONTROL

1. Operate only with the teacher's permission and after instructions have been received.
2. Do not look into the light which is used for exposing the plates. Ultraviolet light can be harmful to the eyes.
3. Persons wearing contact lenses must be especially careful not to look at the light as this may cause the lens to weld itself to the eye.
4. Do not turn on the light unless the vacuum frame is locked down.
5. Do not touch the photo carbons or light bulbs. They can become very hot.
6. Disconnect the plate maker before changing the carbons or making adjustments. Be careful of hot carbons when changing.
7. Be careful not to break the glass of the vacuum frame. To avoid this, be sure the vacuum is drained before lifting the glass lid.
8. Be sure the exhaust fan is working and the plate area is properly vented.
9. Handle thin metal plates with care. They are sharp.
10. Avoid inhaling fumes from the chemicals used to develop plates. Use all the chemicals in a well-ventilated place.

PLATEMAKER



1 Axle bearing	5 Vacuum frame latch
2 Axle	6 Control panel
3 Glass frame latch	7 Arc control
4 Vacuum frame assembly	

PLATEMAKER SAFETY QUIZ

NAME______________________________

CLASS______________________________

DATE______________GRADE____________

True-False:

T F 1. The platemaker should be disconnected before changing the carbons or making adjustments.

T F 2. Never look into the light used for exposing the plate because it may be harmful to the eyes.

T F 3. The light may be turned on before locking down the vacuum frame.

T F 4. Metal plates are thin and sharp and should be handled with care.

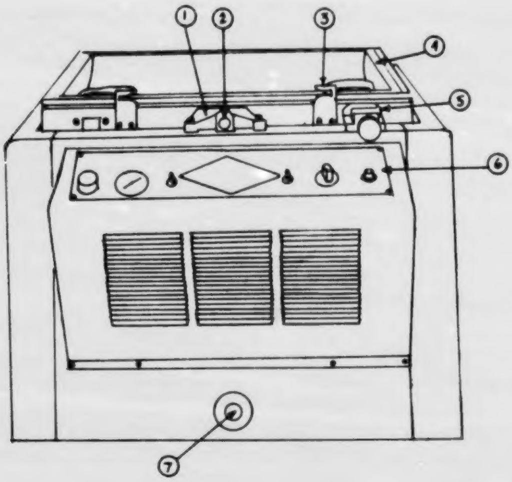
Multiple Choice:

_____ 5. Do not touch photo carbons because: (a) they may break, (b) they may be hot, (c) one may get fingerprints on them, (d) they may be dirty.

_____ 6. Be especially careful not to look at the platemaker light if wearing: (a) contact lenses, (b) sunglasses, (c) eyeglasses, (d) safety goggles.

_____ 7. To avoid breaking the glass of the vacuum frame, before raising the lid be sure to: (a) drain the vacuum, (b) turn off the light, (c) disconnect the platemaker, (d) do all of these.

8. Write the correct name of the machine and each part in the space provided.



A. ______________________________

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5. ______________________________
6. ______________________________
7. ______________________________

KEY

1. T
2. T
3. F
4. T
5. B
6. A
7. A

8A. Platemaker

1. Axle bearing
2. Axle
3. Glass frame catch
4. Vacuum frame assembly
5. Vacuum frame latch
6. Control panel
7. Arc control

OFFSET PRESS

1. Operate only with the teacher's permission and after instructions have been received.

2. Stop the press before adjusting, cleaning (except when cleaner attachment is being used), oiling, and clearing of jams.

3. Do not reach over the press during operation. Avoid retrieving misfed sheets while the press is in operation.

4. Watch for malfunctions on the press. If a malfunction is observed, the press should be shut down and the teacher informed before continuing work. Do not attempt any repairs.

5. Operate the press only at the speed designated by the teacher.

6. Use caution when cleaning a moving press. Keep the hands away from grippers and moving rollers.

7. Do not use any tools on the press without the teacher's permission.

8. Be sure clothing is safe for press work. Remove or fasten any loose clothing, neckties, or jewelry. Roll loose sleeves to the elbows.

9. Fasten hair securely or wear a protective hair cover if the hairstyle presents a potential hazard.

10. Keep the floor around the press clear and clean at all times. Wipe up or pick up any spilled oil, ink, water, or paper.

11. Avoid any unnecessary conversation when operating the press.

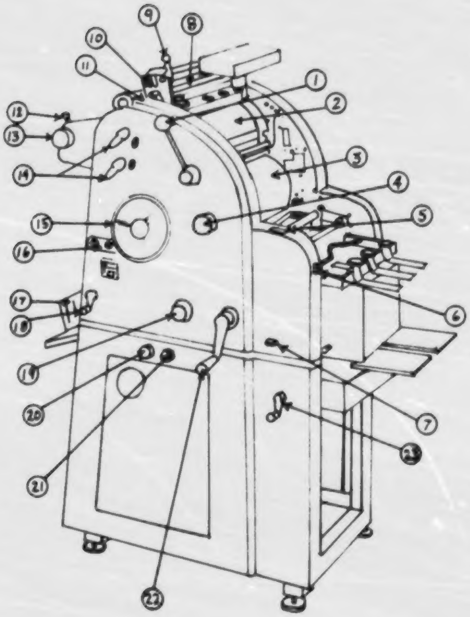
12. Beware of rollers and gears. Keep the covers and guards in place at all times.

13. Do not leave the press while it is in operation.

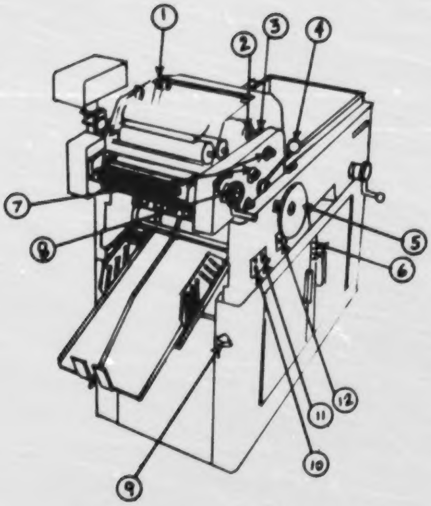
14. Keep solvents in fireproof containers and return dirty rags to the proper container after use.

15. Supply all roller-type printing machines with nip guards. (OSHA)

OFFSET PRESS

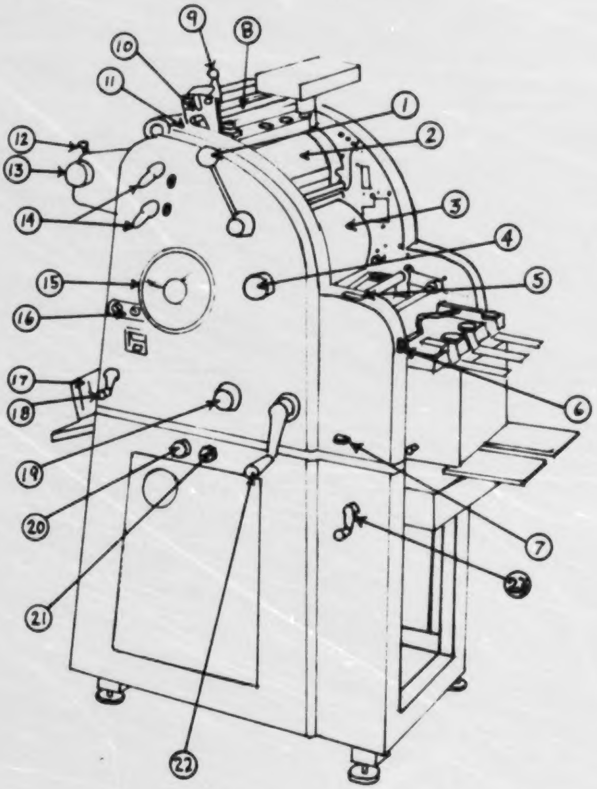


1. OPERATION CONTROL LEVER
2. MASTER CYLINDER
3. BLANKET CYLINDER
4. VERTICAL COPY ADJUSTING LOCK
5. COPY COUNTER
6. PAPER FEED LEVER
7. TABLE RELEASE
8. FOUNTAIN SOLUTION TROUGH
9. AQUAMATIC NIGHT LATCH HANDLE
10. AQUAMATIC CONTROL
11. AQUAMATIC LOCK-OUT LATCH
12. INK FOUNTAIN CONTROL
13. INK FOUNTAIN ROLLER KNOB
14. FORM ROLLER CONTROL LEVERS
15. HAND WHEEL
16. MOTOR DRIVE AND VACUUM PUMP SWITCHES
17. RECEIVING TRAY
18. SPEED CONTROL
19. BUCKLE CONTROL
20. AIR CONTROL
21. VACUUM CONTROL
22. PAPER ELEVATOR CRANK
23. PAPER GUIDE CRANK



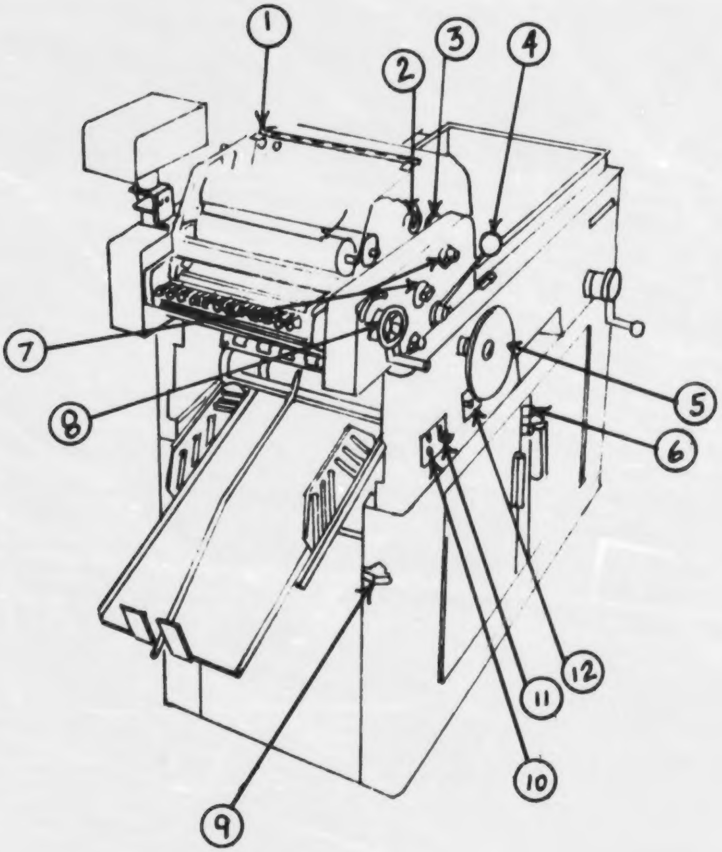
1. REPELEX CONTROLS
2. REPELEX FOUNTAIN ROLLER KNOB
3. REPELEX FORM ROLLER CONTROL KNOB
4. SINGLE LEVER CONTROL
5. HANDWHEEL
6. VACUUM AND BLOWER CONTROLS
7. INK FORM ROLLER CONTROL KNOBS
8. INK FOUNTAIN ROLLER KNOB
9. SPEED CONTROL
10. MACHINE SWITCH
11. VACUUM FEEDER SWITCH
12. IMPRESSION ADJUSTMENT

OFFSET PRESS



1 Operation control lever
2 Master cylinder
3 Blanket cylinder
4 Vertical copy adjusting lock
5 Copy counter
6 Paper feed lever
7 Table release
8 Fountain solution trough
9 Aquamatic night latch handle
10 Aquamatic control
11 Aquamatic lock-out latch
12 Ink fountain control
13 Ink fountain roller knob
14 Form roller control levers
15 Hand wheel
16 Motor drive and vacuum pump switches
17 Receiving tray
18 Speed control
19 Buckle control
20 Air control
21 Vacuum control
22 Paper elevator crank
23 Paper guide crank

OFFSET PRESS



1 Repelex controls

2 Repelex fountain roller knob

3 Repelex form roller control knob

4 Single lever control

5 Handwheel

6 Vacuum and blower controls

7 Ink form roller control knobs

8 Ink fountain roller knob

9 Speed control

10 Machine switch

11 Vacuum feeder switch

12 Impression adjustment

OFFSET PRESS SAFETY QUIZ

NAME________________________________

CLASS_______________________________

DATE______________GRADE______________

True-False:

T F 1. It is safe to reach carefully across the press when it is operating.

T F 2. Pupils are not to use any tools on the press without the teacher's permission.

T F 3. Final adjustments may be made while the press is running slowly.

T F 4. Loose or dangling clothing should not be worn when one is working around the press.

T F 5. Talking with others while running the press is allowed if the operator keeps his/her mind on what he/she is doing.

T F 6. Gears need not be covered while the press is in operation if the operator is careful.

T F 7. It is all right to leave the press running if one returns to it immediately.

Multiple Choice:

_____ 8. Before operating the offset press, one should: (a) get the teacher's permission, (b) place all guards in position, (c) have received instruction on how to operate it, (d) have done all of these.

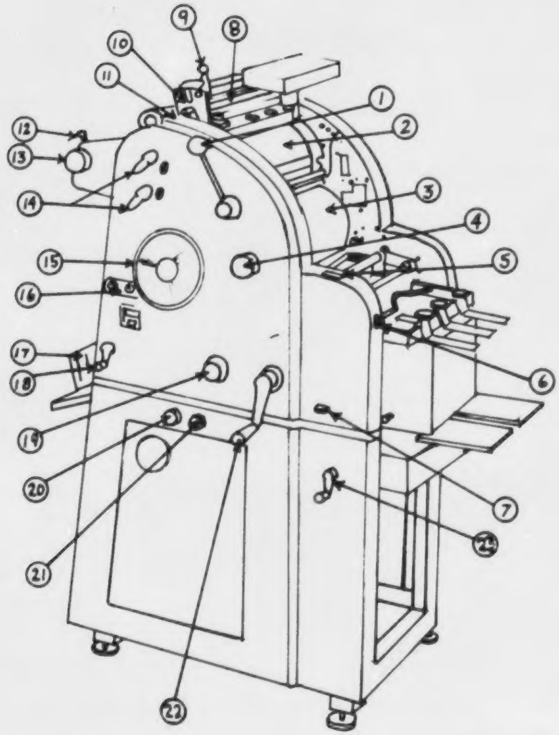
_____ 9. Oily rags should always be placed: (a) in the wastebasket, (b) in the scrap box, (c) in a metal self-closing can, (d) where the next person can find them.

_____10. Scraps, paper, and other litter: (a) may be left on the floor to be swept up later, (b) should be disposed of in the wastebasket, (c) can be ignored because they do not cause a safety hazard, (d) none of these.

_____ 11. Before operating the offset press, one should: (a) tuck in loose clothing, (b) remove rings, watches, and other jewelry, (c) roll up long sleeves, (d) do all of these.

12. Write the correct name of each machine and its parts in the space provided.

A. ______________________________



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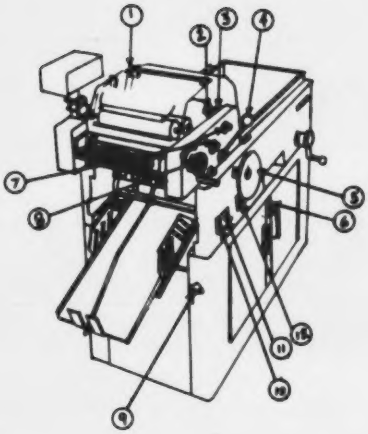
B. ______________________________



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11. ______________________________

12. ______________________________

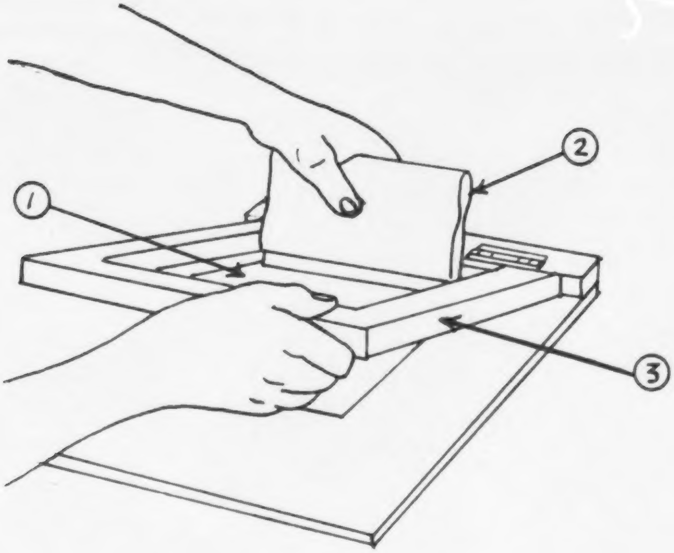
KEY

1. F
2. T
3. F
4. T
5. F
6. F
7. F
8. D
9. C
10. B
11. D

12A. Offset press
    1. Operation control lever
    2. Master cylinder
    3. Blanket cylinder
    4. Vertical copy adjusting lock
    5. Copy counter
    6. Paper feed lever
    7. Table release
    8. Fountain solution trough
    9. Aquamatic night latch handle
    10. Aquamatic control
    11. Aquamatic lock-out latch
    12. Ink fountain control
    13. Ink fountain roller knob
    14. Form roller control levers
    15. Hand wheel
    16. Motor Drive and vacuum pump switches
    17. Receiving tray
    18. Speed control
    19. Buckle control
    20. Air control
    21. Vacuum control
    22. Paper elevator crank
    23. Paper guide crank

B. Offset press
    1. Repelex controls
    2. Repelex fountain roller knob
    3. Repelex form roller control knob
    4. Single lever control
    5. Handwheel
    6. Vacuum and blower controls
    7. Ink form roller control knobs
    8. Ink fountain roller knob
    9. Speed control
    10. Machine switch
    11. Vacuum feeder switch
    12. Impression adjustment

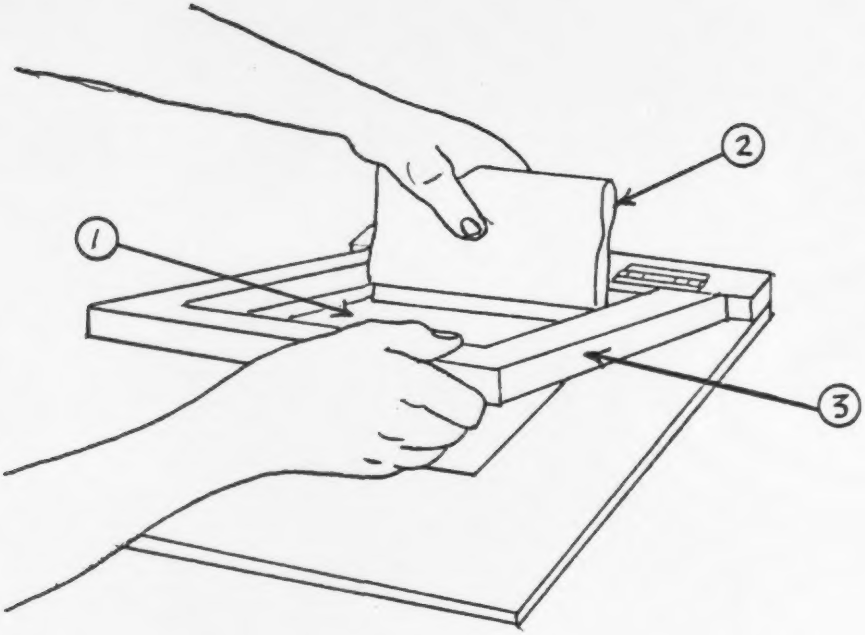
SCREEN PRINTER



1. SCREEN
2. SQUEEGEE
3. FRAME

1. Use all tools and materials in the screen printing area only with the teacher's permission and after instructions have been received.
2. When exposing photo stencils, avoid looking directly at the exposure lights.
3. Follow standard darkroom safety procedures when preparing materials for photo stencils.
4. Use stencil cutting tools in approved holders and keep the cutting edges sharp.
5. Use screen inks and cleaners only in well-ventilated areas. Many of them give off toxic fumes.
6. Wear appropriate eye protection when working with screen cleaners and inks.
7. Return cleaning rags to the approved metal fireproof containers.
8. If using a motorized screen press, be careful that the hands do not become caught under the screen or in the moving parts of the press.
9. Clean up oils, paints, or inks that are spilled on the floor.
10. Keep flammable liquids in approved containers and cabinets.

SCREEN PRINTER



1 SCREEN
2 SQUEEGEE
3 FRAME

SCREEN PRINTER SAFETY QUIZ

NAME______________________________

CLASS______________________________

DATE_______________GRADE_______________

True-False:

T F 1. Many screen inks and cleaners give off toxic fumes.

T F 2. Photo stencil exposure lights are not very bright; therefore, no special precautions need to be taken when working around such lights.

T F 3. Special darkroom safety procedures need to be followed when preparing materials for photo stencils.

T F 4. Flammable liquids should be stored in metal fireproof containers.

Multiple Choice:

_____ 5. Stencil cutting tools should be: (a) sharp, (b) used only in approved holders, (c) stored properly after use, (d) all of these.

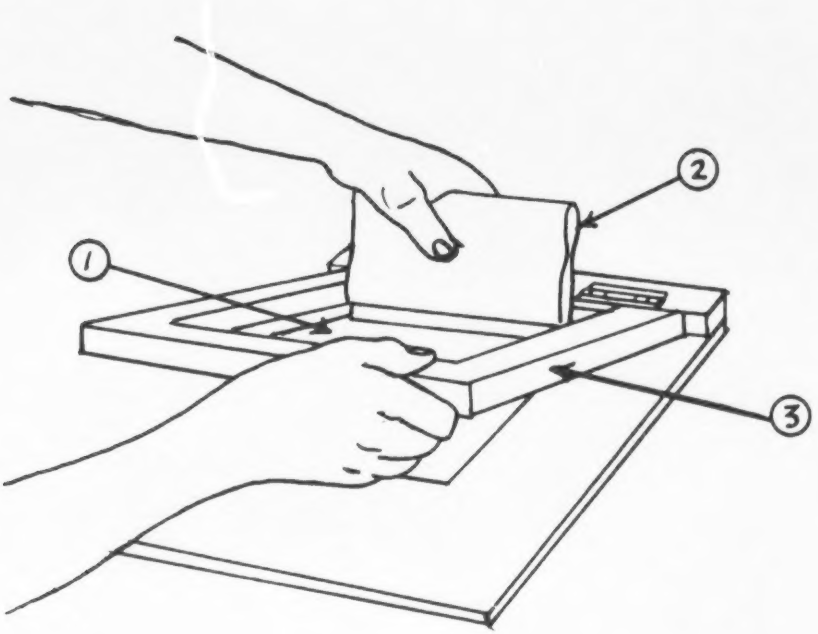
_____ 6. If a pupil doesn't understand a silkscreen operation, he/she should: (a) ask the teacher for help, (b) ask another pupil who knows, (c) go ahead as planned and hope it works, (d) do none of these.

_____ 7. When working with screen inks and cleaners: (a) wear appropriate eye protection, (b) work only in a well-ventilated area, (c) wash hands after use, (d) do all of these.

_____ 8. After use, cleaning rags should be: (a) placed in metal fireproof container, (b) thrown in the wastebasket, (c) left for the next pupil to use, (d) rolled up in a neat bundle.

_____ 9. If oils, paints, or inks spill on the floor: (a) be careful not to slip on it until clean-up time, (b) clean it up at once, (c) inform the teacher, (d) warn others not to step in it.

Write the correct name of each part in the space provided.



1.____________________________ 3.____________________________

2.____________________________

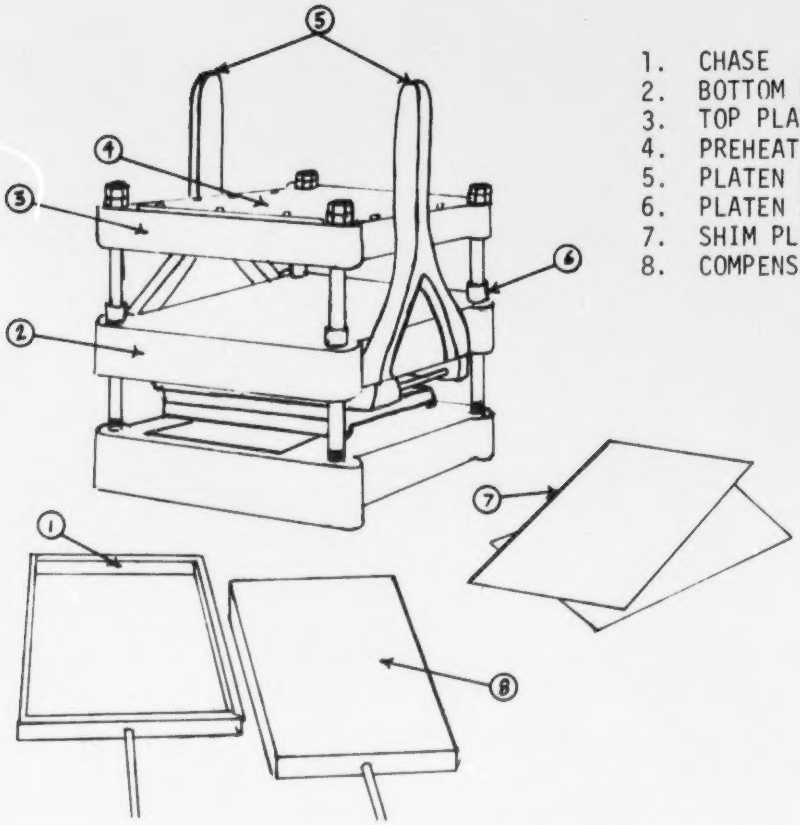
KEY

1. T
2. F
3. T
4. T
5. D
6. A
7. D
8. A
9. B

Parts Identification

1. Screen
2. Squeegee
3. Frame

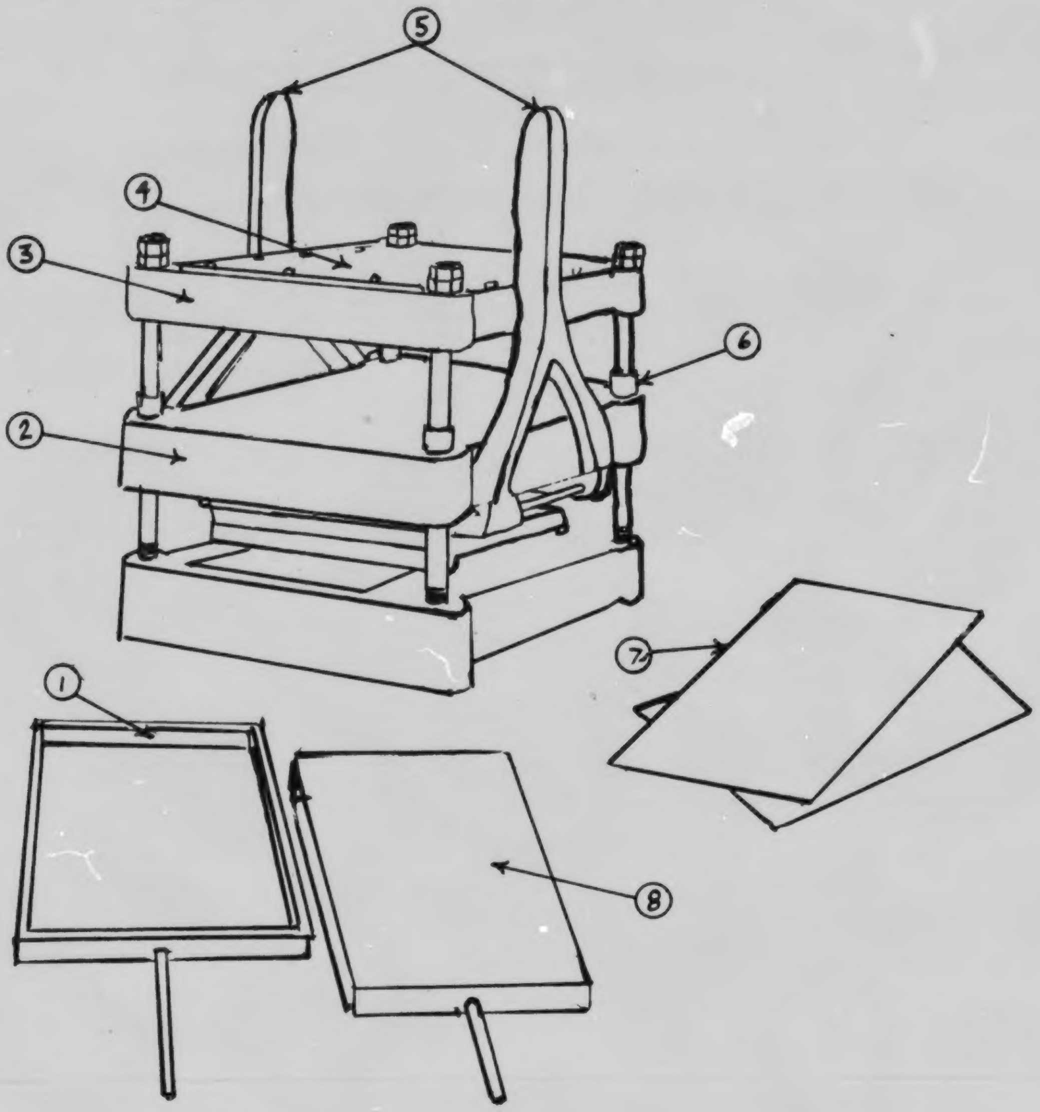
RUBBER STAMP AND GOLD STAMP PRESS



1. CHASE
2. BOTTOM PLATEN
3. TOP PLATEN
4. PREHEAT AREA
5. PLATEN LEVERS
6. PLATEN SPACERS
7. SHIM PLATES
8. COMPENSATING BLOCK

1. Operate only with the teacher's permission and after instructions have been received.
2. Use caution when using the heating element as it can cause severe burns.
3. Keep the work surface clean at all times.
4. Do not throw or drop type.
5. Take extreme care when operating a rubber stamp press, as many parts of it get very hot during use.
6. When making the stamp base, be very careful with the saw and drill.

RUBBER STAMP AND GOLD STAMP PRESS



1 Chase
2 Bottom platen
3 Top platen
4 Preheat area
5 Platen levers
6 Platen spacers
7 Shim plates
8 Compensating block

RUBBER STAMP AND GOLD STAMP PRESS SAFETY QUIZ

NAME ______________________________

CLASS ______________________________

DATE ____________ GRADE ________________

True-False:

T F 1. Do not take extra safety measures when using the rubber stamp press because it only becomes warm, not hot, during use.

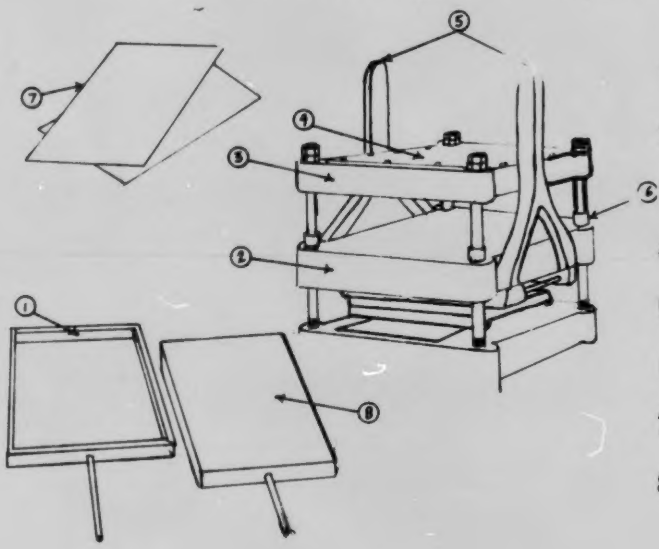
T F 2. Be especially careful with the saw and drill which are used in making the stamp base.

Multiple Choice:

_____ 3. Before operating the rubber stamp press or the gold stamp press, one should: (a) get the teacher's permission, (b) ask another pupil for instructions on how to operate them, (c) have received teacher instructions on how to operate them (d) both a and c above.

_____ 4. Keep the work area: (a) cluttered, (b) clean, (c) none of these.

Write the correct name of each part in the space provided.



1. ____________________

2. ____________________

3. ____________________

4. ____________________

5. ____________________

6. ____________________

7. ____________________

8. ____________________

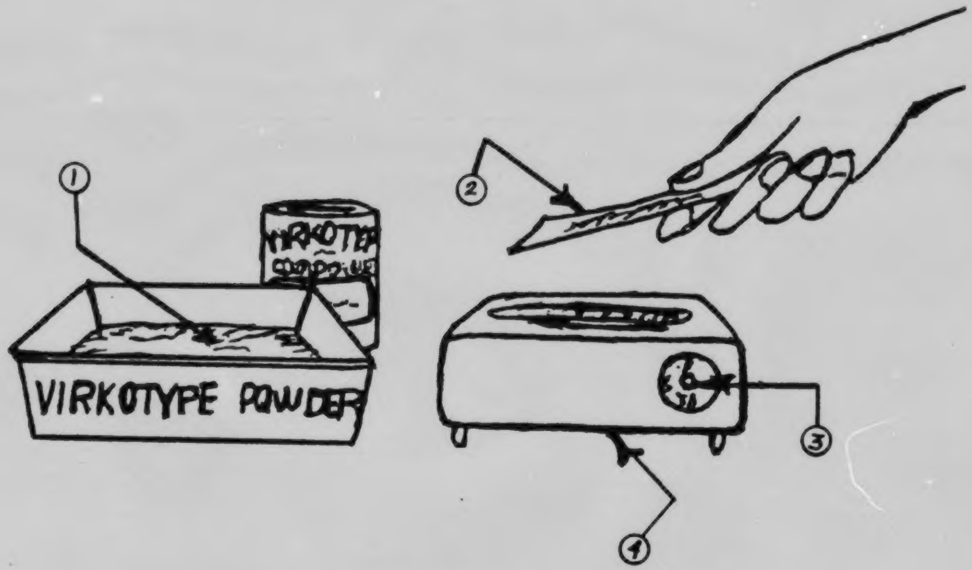
KEY

1. F
2. T
3. D
4. B

Parts Identification

1. Chase
2. Bottom platen
3. Top platen
4. Preheat area
5. Platen levers
6. Platen spacers
7. Shim plates
8. Compensating block

THERMOGRAPHY



1. POWDER
2. PAPER WITH POWDER
3. THERMOSTAT
4. HOT PLATE

1. This project should be done only with the teacher's permission and after instructions have been received.

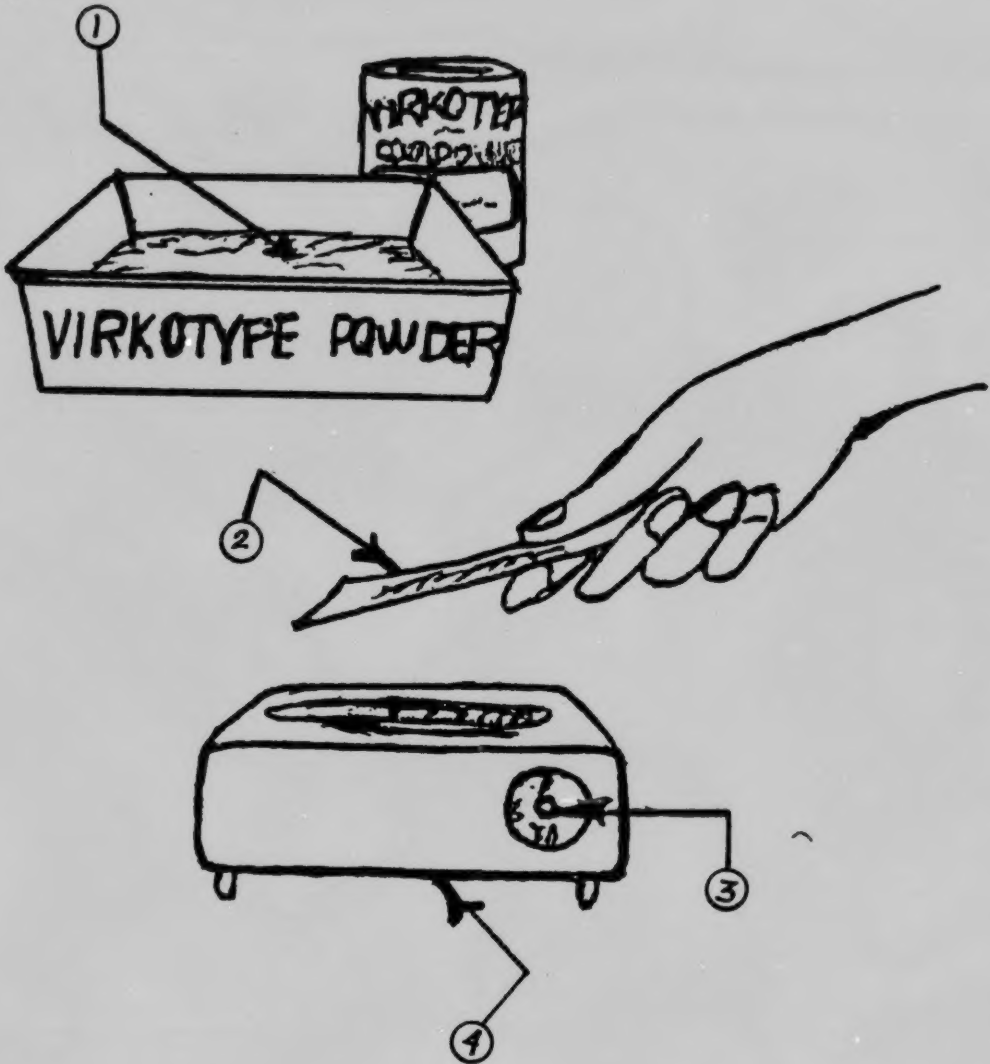
2. If a heat lamp is used as a heat source, dark goggles should be worn.

3. An electric hot plate must not be left unattended since fire might result.

4. Virkotyping powder is flammable and could cause a fire if not used properly.

5. The paper onto which the powder is being fused should not be allowed to catch fire.

THERMOGRAPHY


①
VIRKOTYPE
VIRKOTYPE POWDER
②
③
④

1	Powder	3	Thermostat
2	Paper with powder	4	Hot plate

THERMOGRAPHY SAFETY QUIZ

NAME ______________________________

CLASS _____________________________

DATE _____________ GRADE __________

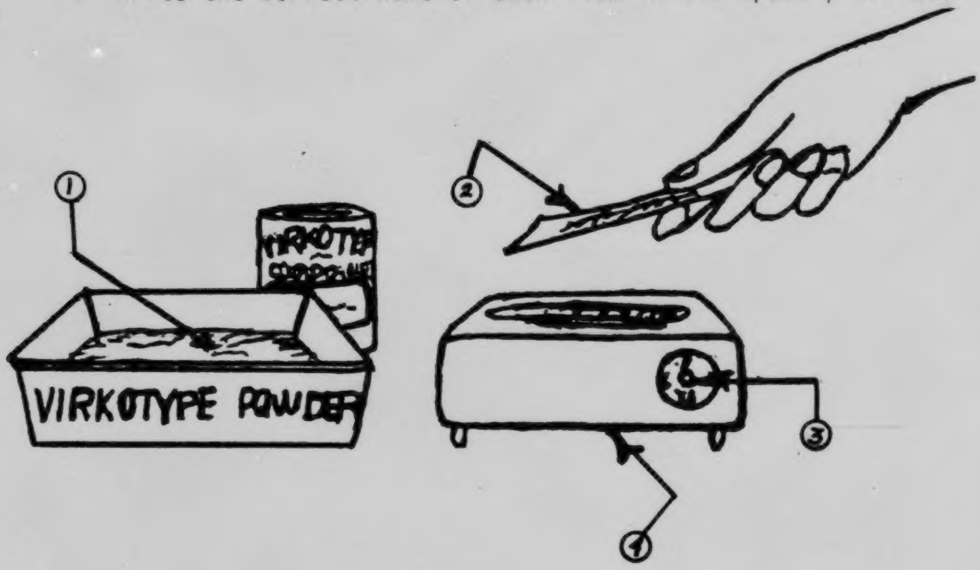
True-False

T F 1. If a heat lamp is used as a heat source, the pupil does not need to wear dark goggles.

T F 2. Virkotyping powder will not burn so no special safety precautions need to be observed.

T F 3. An electric hot plate should not be left unattended since a fire might result.

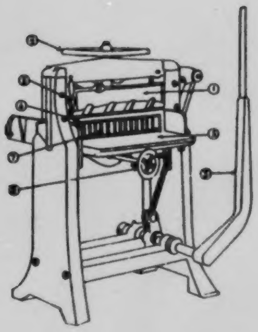
4. Write the correct name of each item in the space provided.



1. ____________________ 3. ____________________

2. ____________________ 4. ____________________

PAPER CUTTER



1. MEASURING TAPE
2. BED
3. LEVER
4. CLAMP WHEEL
5. SAFETY
6. CUTTER BLADE
7. BACK FENCE
8. BACK FENCE WHEEL

1. Operate only with the teacher's permission and after instructions have been received.

2. Make sure no one else is inside the operator's zone. The paper cutter is a one-person machine.

3. Never work on the paper cutter unless safety devices are present and in working order.

4. Be certain the handle (lever) controlling the blade is in its proper position, and the safety lock is engaged, before setting the back gauge.

5. Never raise the clamp higher than the knife blade.

6. Limit the amount of stock to be cut at any one time. Do not overload.

7. Keep hands clear of the blade at all times. Under no circumstances should the blade ever be touched.

8. Keep both hands on the handle (lever or levers) controlling the blade during the cut and then return it to its proper position.

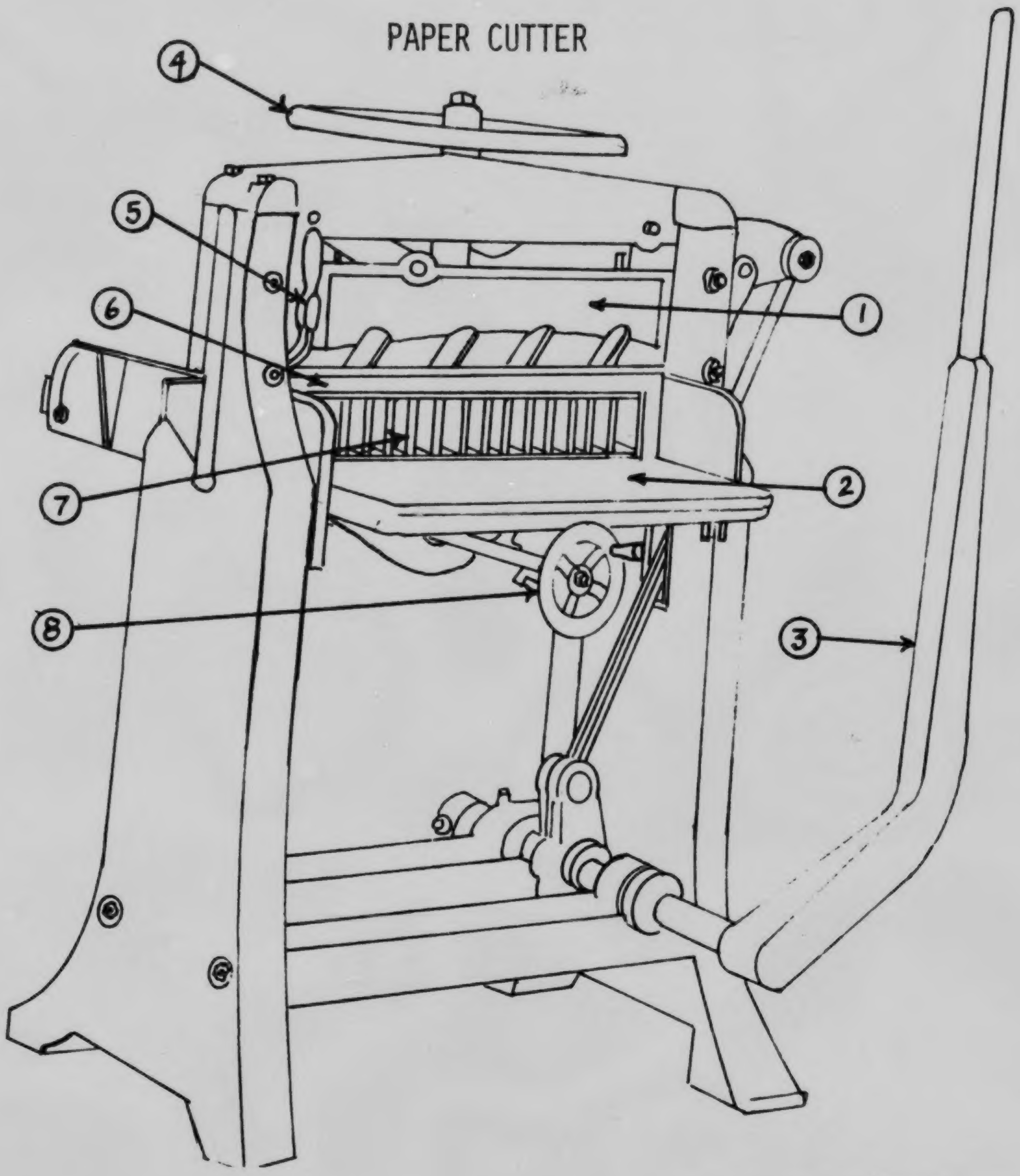
9. Be sure the handle (lever) controlling the blade is returned to its proper position before reaching for the cut stock.

10. Check to see that the safety lock engages after using the cutter.

11. Changing of the cutter knife should be done by the teacher.

12. Allow no foreign objects to come into contact with the paper cutter knife or to lie on the cutter table. Paper cutters must be used only for cutting paper.

PAPER CUTTER



1 MEASURING TAPE
2 BED
3 LEVER
4 CLAMP WHEEL
5 SAFETY
6 CUTTER BLADE
7 BACK FENCE
8 BACK FENCE WHEEL

PAPER CUTTER SAFETY QUIZ

NAME ______________________________

CLASS ______________________________

DATE ______________ GRADE ___________

True-False:

T F 1. Use the paper cutter to cut plastic items, thin pieces of wood, etc., as well as paper.

T F 2. Keep both hands on the handle when using the cutter.

T F 3. Cut beyond the capacity of the paper cutter because most machines have an overload designed into them.

T F 4. Ask a friend to help operate the paper cutter because it is a two-person job.

T F 5. Under no circumstances should the paper cutter blade ever be touched by the pupil.

T F 6. Clean, oil, and adjust the paper cutter with the machine operating, if it is power operated.

Multiple Choice:

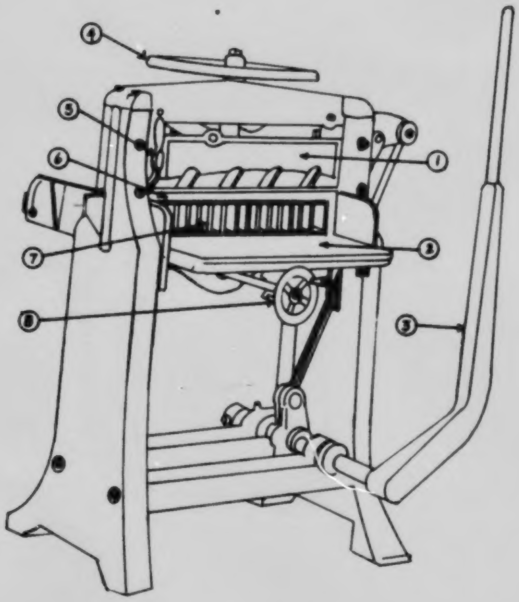
_____ 7. Before adjusting the paper cutter, be sure that the handle controlling the blade: (a) is locked in its proper position, (b) is in a downward position, (c) has the clamp down, (d) has the knife down.

_____ 8. Reach for the cut stock when: (a) the blade is on the upward stroke, (b) the blade is on the downward stroke, (c) the handle controlling the blade has returned to its proper position, (d) the clamp is down.

_____ 9. When operating the paper cutter, be sure to keep: (a) both hands on the handle, (b) only one hand on the handle, (c) one hand on the stock, (d) one hand on the back gauge adjuster.

_____ 10. Use the paper cutter: (a) anytime the teacher is in the room, (b) only after the teacher's permission has been received, (c) anytime it's needed, (d) after watching others operate it.

11. Write the correct name of the machine and its parts in the space provided.



A.____

1.__________________________

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7.__________________________

8.__________________________

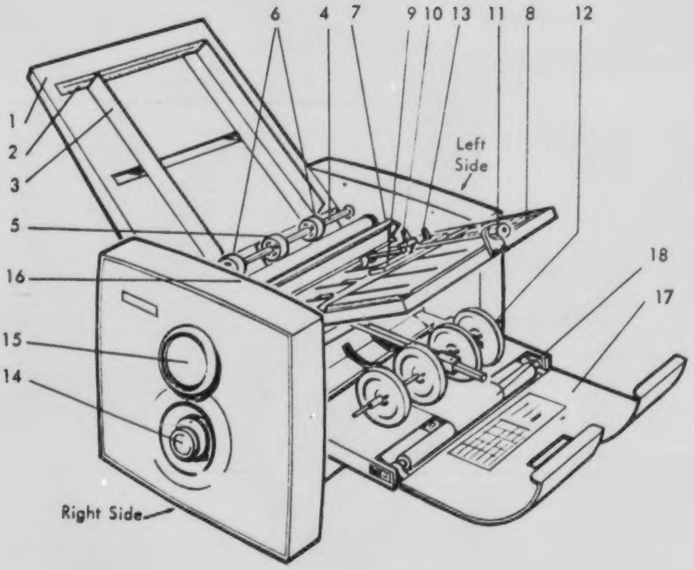
KEY

1. F
2. T
3. F
4. F
5. T
6. F
7. A
8. C
9. A
10. B

11A. Paper Cutter

    1. Measuring tape
    2. Bed
    3. Lever
    4. Clamp wheel
    5. Safety
    6. Cutter blade
    7. Back fence
    8. Back fence wheel

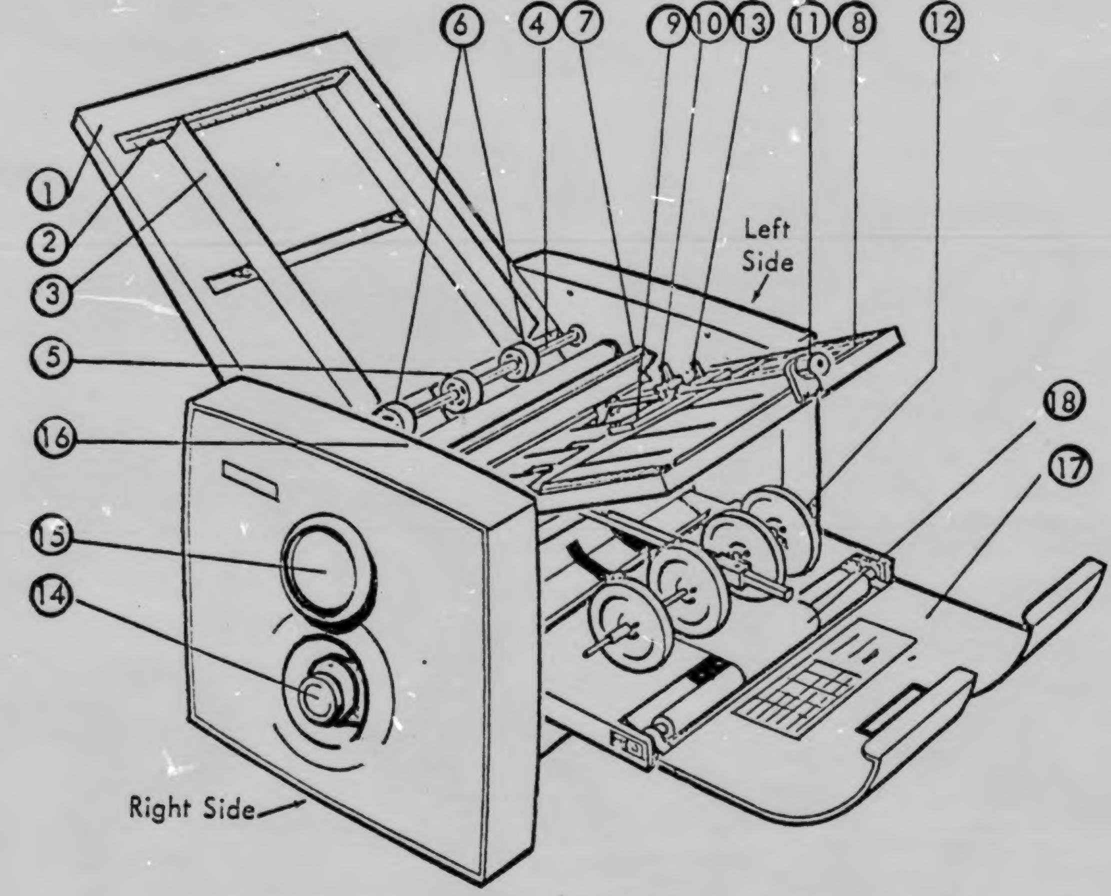
FOLDER



1. FEED TRAY
2. FEED TRAY SCALE
3. GUIDE BARS
4. AUTOFEED SHAFT
5. AUTOFEED WHEEL
6. STEADY WHEELS
7. UPPER DEFLECTOR
8. UPPER TRAY
9. ADJUSTABLE STOP
10. ADJUSTABLE STOP SCREW
11. MICRO ADJUSTER
12. STACKER WHEELS
13. STOP ALIGNMENT SCREW
14 SPEED CONTROL
15. HAND WHEEL
16. MOTOR SWITCH (Not Shown) Inside of Frame
17. RECEIVING TRAY
18. CONVEYOR

1. Operate only with the teacher's permission and after instructions have been received.
2. Secure or eliminate loose clothing, long hair, and jewelry.
3. Keep the hands away from the moving rollers in the folder.
4. Do not attempt to remove a misfed or jammed sheet while the machine is running.
5. Turn off the power when making changes in the folder settings for different sized sheets of paper.
6. Keep all tools off the tables of the folder.
7. Be sure the electrical cord is out of the way.
8. Report any folder malfunctions to the teacher.

FOLDER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2
3
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15
14
18
17
Left Side
Right Side

1 FEED TRAY
2 FEED TRAY SCALE
3 GUIDE BARS
4 AUTOFEED SHAFT
5 AUTOFEED WHEEL
6 STEADY WHEELS
7 UPPER DEFLECTOR
8 UPPER TRAY
9 ADJUSTABLE STOP
10 ADJUSTABLE STOP SCREW
11 MICRO ADJUSTER
12 STACKER WHEELS
13 STOP ALIGNMENT SCREW
14 SPEED CONTROL
15 HAND WHEEL
16 MOTOR SWITCH (Not Shown) Inside of Frame
17 RECEIVING TRAY
18 CONVEYOR

FOLDER SAFETY QUIZ

NAME______________________________

CLASS_____________________________

DATE______________GRADE____________

True-False:

T F 1. Jammed or misfed sheets may be removed while the machine is running, if it is running slowly.

T F 2. Power should be turned off when making changes in the folder settings for different sized sheets of paper.

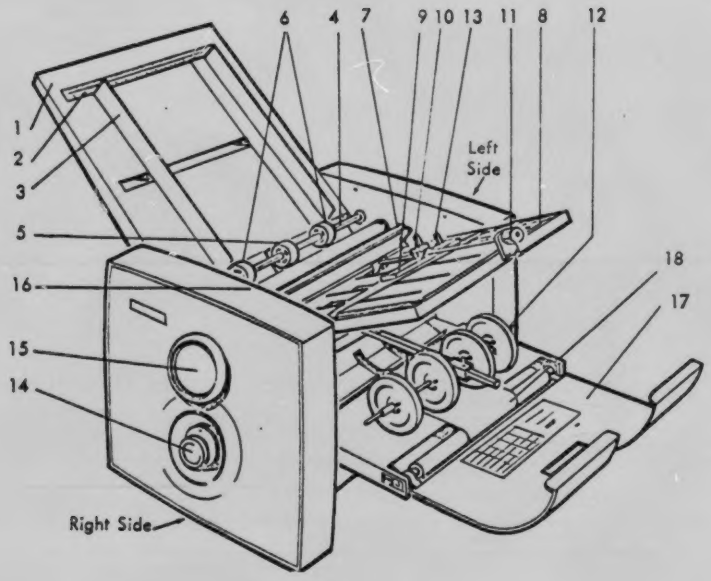
T F 3. Loose clothing and long hair should be secured before operating the folder.

T F 4. A pupil who doesn't know how to operate a folder should ask another pupil to show him/her how to do it.

T F 5. Tools being used should be laid on the tables of the folder.

T F 6. Fingers must be kept away from moving rollers.

7. Write the correct name of the machine and its parts in the space provided.
(see next page)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Left Side
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16
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14
Right Side

A. ____________________

1. ____________________ 10. ____________________

2. ____________________ 11. ____________________

3. ____________________ 12. ____________________

4. ____________________ 13. ____________________

5. ____________________ 14. ____________________

6. ____________________ 15. ____________________

7. ____________________ 16. ____________________

8. ____________________ 17. ____________________

9. ____________________ 18. ____________________

KEY

1. F

2. T

3. T

4. F

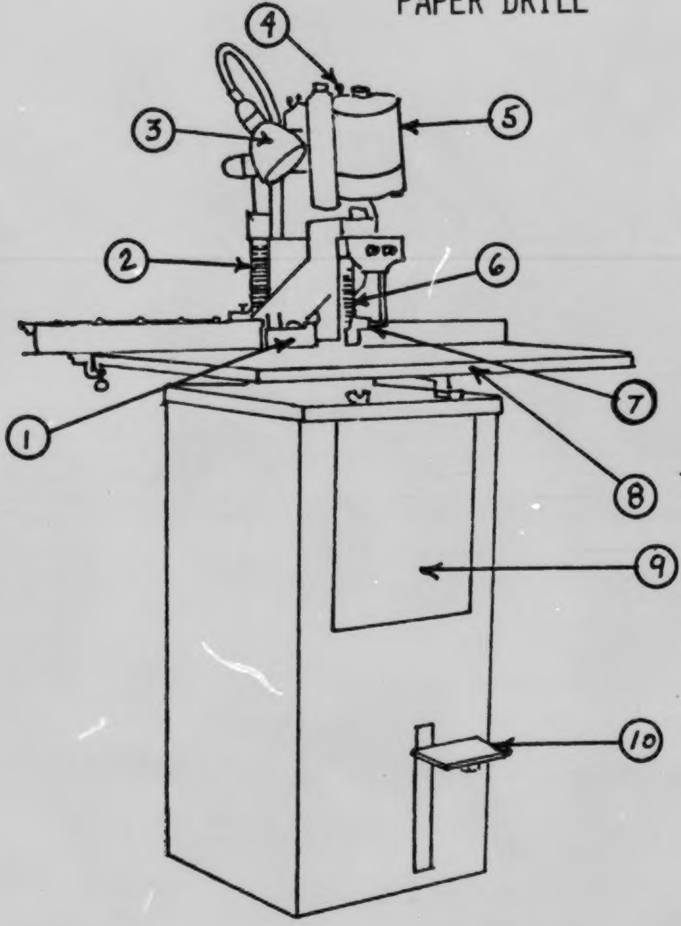
5. F

6. T

7A. Folder

    1. Feed tray
    2. Feed tray scale
    3. Guide bars
    4. Autofeed shaft
    5. Autofeed wheel
    6. Steady wheels
    7. Upper deflector
    8. Upper tray
    9. Adjustable stop
    10. Adjustable stop screw
    11. Micro adjuster
    12. Stacker wheels
    13. Stop alignment screw
    14. Speed control
    15. Hand wheel
    16. Motor switch
    17. Receiving tray
    18. Conveyor

PAPER DRILL



1. PAPER GUIDE
2. SPRING TENSION
3. LAMP
4. SWITCH
5. MOTOR
6. HOLLOW DRILL
7. PAPER HOLDER
8. TABLE
9. STORAGE
10. FOOT PEDAL

1. Operate only with the teacher's permission and after instructions have been received.

2. Be sure the paper guide is securely fastened before turning on the machine.

3. Hold the paper securely against the paper guide.

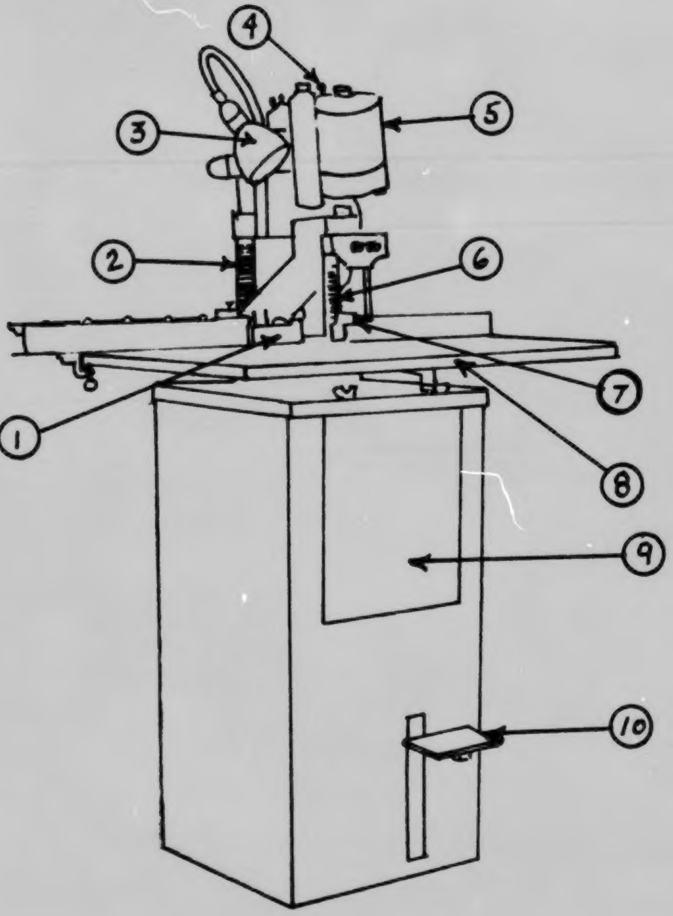
4. Be sure the fingers are clear before stepping on the foot pedal.

5. Let the foot pedal return slowly.

6. Be aware that the drill bit may be hot.

7. Keep the area around the feet clear at all times.

PAPER DRILL



1 Paper guide
2 Spring tension
3 Lamp
4 Switch
5 Motor
6 Hollow drill
7 Paper holder
8 Table
9 Storage
10 Foot pedal

PAPER DRILL SAFETY QUIZ

NAME______________________________________

CLASS______________________________________

DATE____________________GRADE______________

True-False:

T F 1. Be sure the paper guide is unfastened before turning on the machine.

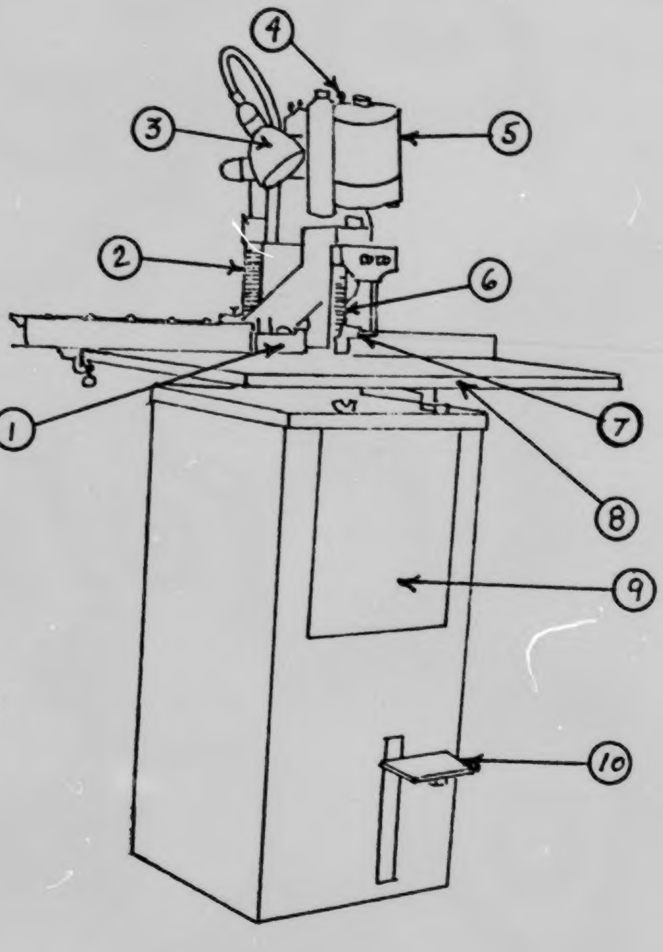
T F 2. Hold the paper loosely against the paper guide.

T F 3. Allow the foot pedal to return slowly.

T F 4. Use of the drill bit may cause it to become hot.

5. Write the correct name of the machine and its parts in the space provided.

(see next page.)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A.________________________________

1.________________________ 6.________________________

2.________________________ 7.________________________

3.________________________ 8.________________________

4.________________________ 9.________________________

5.________________________ 10.________________________

KEY

1. F

2. F

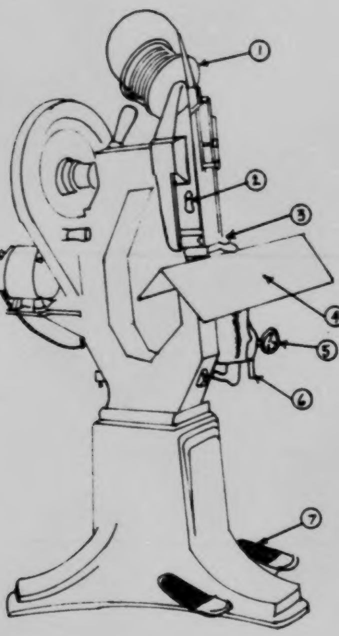
3. T

4. T

5A. Paper Drill

   1. Paper guide
   2. Spring tension
   3. Lamp
   4. Switch
   5. Motor
   6. Hollow drill
   7. Paper holder
   8. Table
   9. Storage
   10. Foot pedal

STAPLER



1. SPOOL OF WIRE
2. WIRE LENGTH ADJUSTMENT
3. STITCHING HEAD
4. TABLE FOR SADDLE STITCHING
5. THICKNESS CONTROL WHEEL
6. THICKNESS GAUGE
7. TRIP PEDAL

1. Operate only with the teacher's permission and after instructions have been received.

2. Adjust the machine only when the power is turned off.

3. In case a staple jams in the clinchers, turn the machine off before removing the staple.

4. Make sure that no one else is inside the operator's zone.

5. Keep the hands away from the movable parts of the stapler, especially the head and clincher, in order to prevent driving a staple into the fingers or hands.

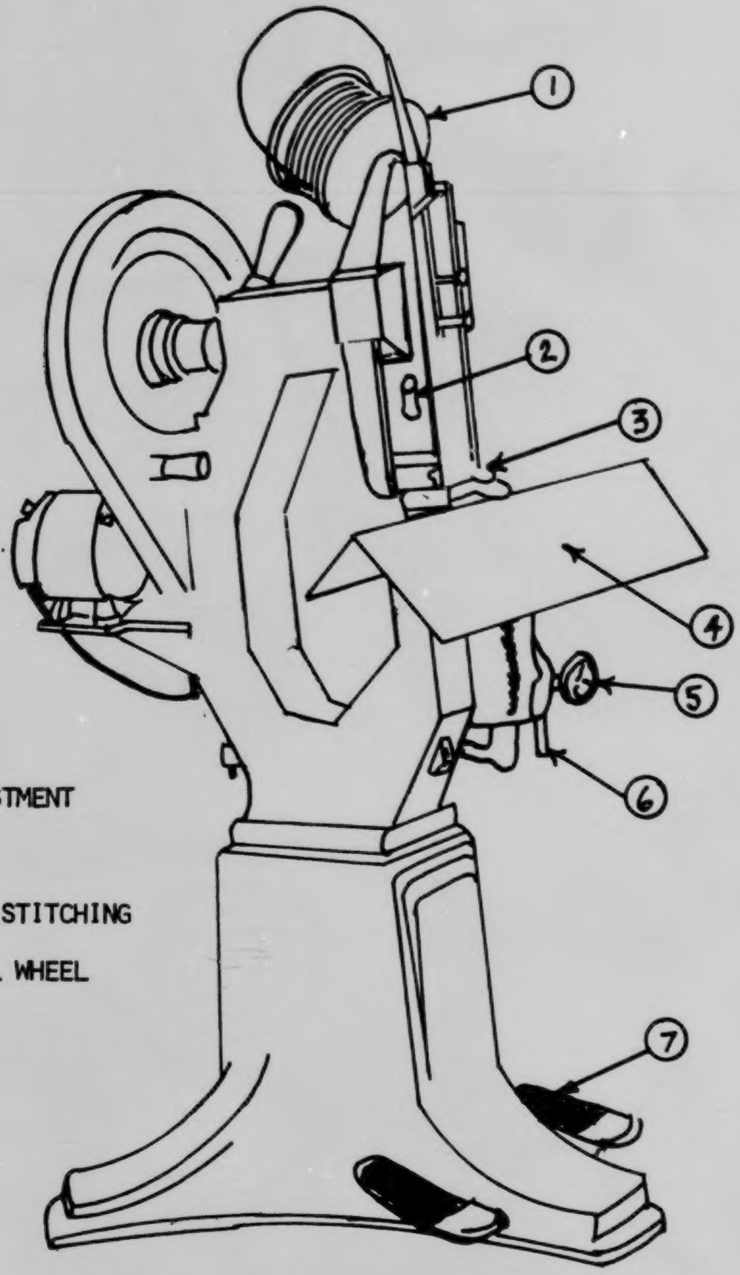
6. Place the foot firmly on the lever control.

7. When loading or unloading staples or wire, be very careful that the wire does not spring back or whip into the face or eyes.

8. Turn off the power after using the stapler.

9. Install a guard on all rotary staple cutters, completely enclosing the cutter to prevent the hands of the operator from reaching the cutting zone. (OSHA)

STAPLER



1 SPOOL OF WIRE
2 WIRE LENGTH ADJUSTMENT
3 STITCHING HEAD
4 TABLE FOR SADDLE STITCHING
5 THICKNESS CONTROL WHEEL
6 THICKNESS GAUGE
7 TRIP PEDAL

STAPLER SAFETY QUIZ

NAME________________________________

CLASS_______________________________

DATE_______________GRADE____________

True-False:

T F 1. If a staple jams in the clinchers, reach in quickly and remove it.

T F 2. Remember that the wire may spring back or whip into the face or eyes when loading staples.

T F 3. After using the stapler, leave it turned on for the next person.

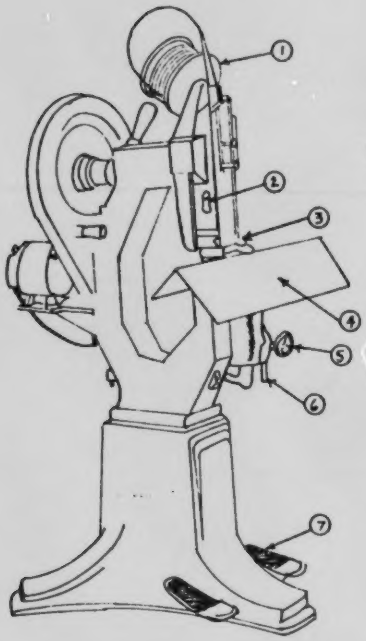
Multiple Choice:

_____ 4. During operation of the stapler, the following persons may be involved: (a) the operator only, (b) the operator plus a helper requested by the operator, (c) the operator, helper, and no more than one observer, (d) any number of people, as long as they don't distract the operator.

_____ 5. Use the stapler: (a) anytime the teacher is in the room, (b) only after receiving the teacher's permission, (c) only after the teacher has given instructions, (d) both b and c.

_____ 6. Adjust the stapling machine: (a) when it is in motion, (b) after each staple, (c) when the power is off, (d) (d) when the power is turned on.

Write the correct name of each part in the space provided.



1. ______________________________

2. ______________________________

3. ______________________________

4. ______________________________

5. ______________________________

6. ______________________________

7. ______________________________

KEY

1. F
2. T
3. F
4. A
5. D
6. C

Parts identification:

1. Spool of wire
2. Wire length adjustment
3. Stitching head
4. Table for saddle stitching
5. Thickness control wheel
6. Thickness
7. Trip pedal

DARKROOM

(GRAPHIC ARTS/PHOTOGRAPHY)

1. There will be no unsafe conduct or horseplay in the darkroom.
2. The ventilator fan should be turned on whenever someone is using the darkroom.
3. The darkroom must be kept clean and the floor clear of obstructions.
4. All spills should be wiped up immediately.
5. Due to the low light level in the darkroom, extreme care must be taken to avoid running into objects. Do not start working until the eyes adjust to the light.
6. The hands must be kept away from the face while working in the darkroom.
7. Chemical goggles, rubber gloves, and an apron should be worn when preparing chemical solutions.
8. A person working in the darkroom should make sure of the formula and mixing procedure before handling chemicals.
9. Contents of bottles and containers must be identified by labels; never trust one's smell. Never taste chemicals!
10. Chemicals are to be mixed only in well-lighted places.
11. Acid must always be added to water; never the opposite.
12. Because of the danger of an explosion, one should never shake a bottle of strong acid or alkali.
13. Chemicals must not be spilled on clothing as it may cause skin irritation.
14. Tongs or rubber gloves should be used in handling film and paper during the developing process.
15. Hands are to be carefully washed with soap and water after developing film or prints.
16. Chemicals should not be stored in glass bottles or on high shelves where they may fall and cause injury.
17. Many photographic chemicals are poisonous and/or caustic and should be kept out of the reach of children.

18. Pupils must realize that contact with photographic chemicals may cause skin rashes or irritation and may cause other health problems, some of which may not be evident for months or years.

19. Electrical equipment must not be handled with wet hands or while standing on a wet floor.

20. A person should not touch any electrical device when working around a sink unless the device is properly grounded.

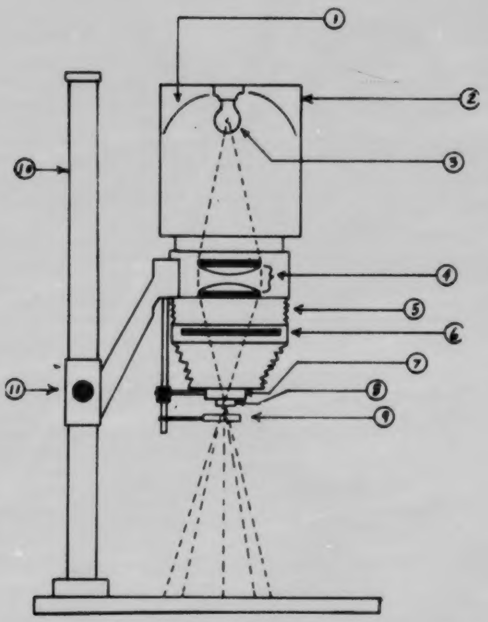
21. All water temperature control units in darkrooms will be operated only by the teacher, not the pupils.

22. The instructor should change burned-out safelight bulbs. Some require special handling to be changed safely.

23. All loose clothing and long hair must be secured, when operating the color drum processor.

(Refer to Section XIII-Chemicals)

DARKROOM EQUIPMENT



ENLARGER

1. REFLECTOR
2. LAMP HOUSING
3. LAMP
4. CONDENSER
5. BELLOWS
6. NEGATIVE CARRIER
7. LENS BOARD
8. LENS
9. FILTER
10. POST
11. VERTICAL ADJUSTMENT

1. Operate it only with the teacher's permission and after instructions have been received.

2. Do not touch the enlarger with wet hands or when standing on a wet floor.

3. Be sure all the electrical wiring is in good condition before operating the enlarger.

4. Change a burned-out enlarger light bulb in a well-lighted area.

5. Be careful not to pinch the fingers in the gears when raising or lowering the enlarger head (while focusing).

6. Be careful when handling the lens and condenser lens.

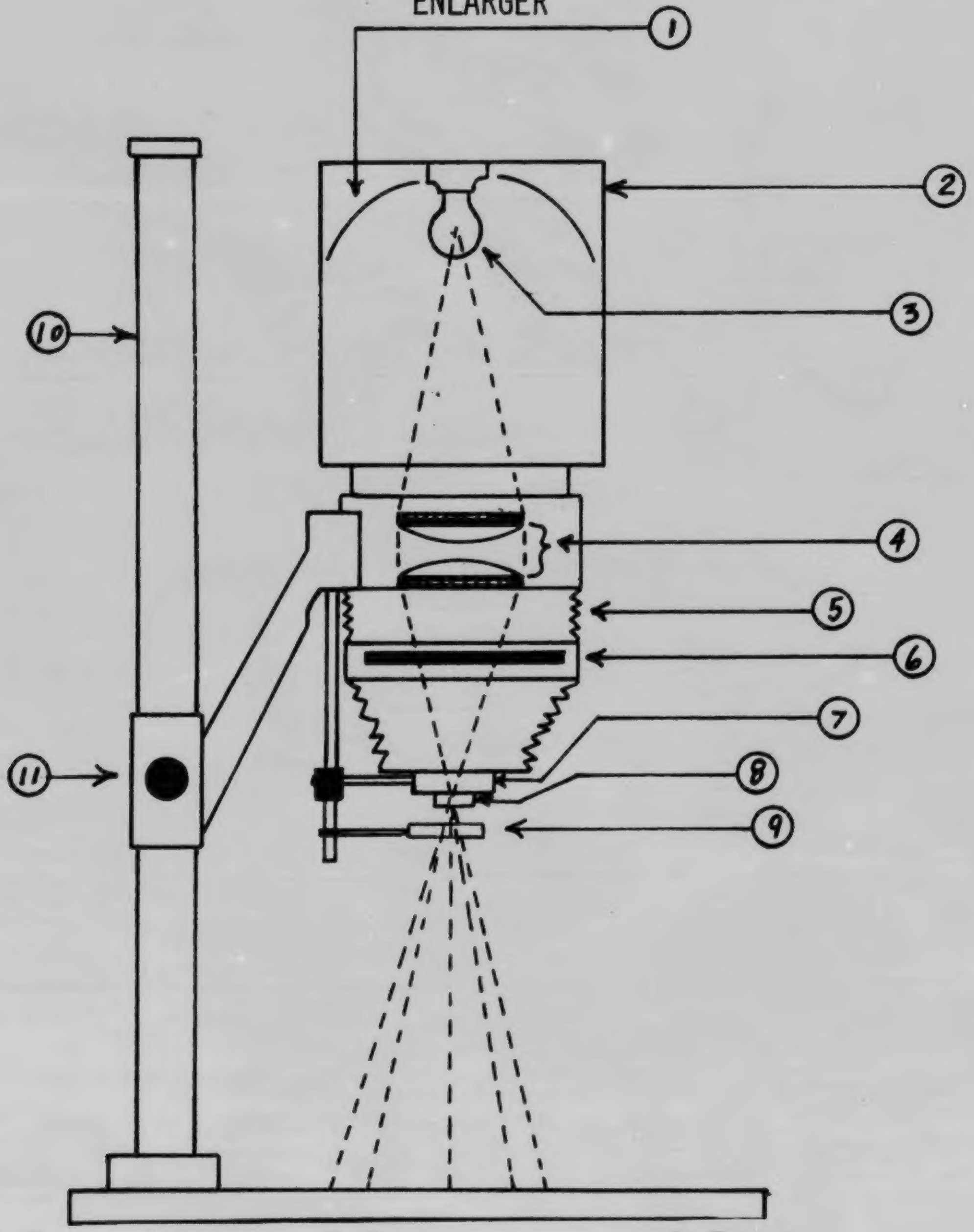
7. Know how the timer on the enlarger operates. Treat it as carefully as any other electrical tool.

8. When raising the enlarger head, check to see that there is proper clearance overhead for the safelight.

9. Before raising or lowering the enlarger head, release the brake/locking mechanism.

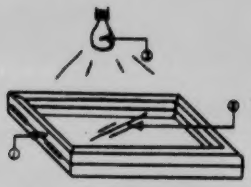
10. Make certain one's head is clear of the enlarger head before raising or lowering it.

ENLARGER



1 REFLECTOR
2 LAMP HOUSING
3 LAMP
4 CONDENSER
5 BELLOWS
6 NEGATIVE CARRIER
7 LENS BOARD
8 LENS
9 FILTER
10 POST
11 VERTICAL ADJUSTMENT

CONTACT PRINTER

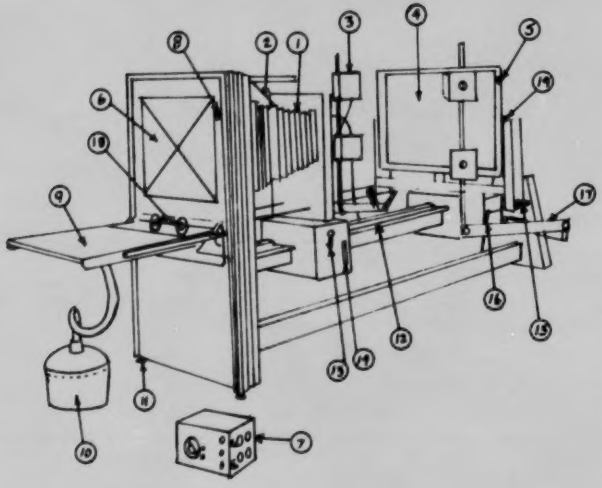


1. FRAME
2. LIGHT SOURCE
3. GLASS

1. Operate only with the teacher's permission and after instructions have been received.

2. When loading the contact printer, be careful not to drop or break the glass.

PROCESS CAMERA



1. BELLOWS
2. BELLOWS SUPPORT
3. QUARTZ LIGHTS
4. COPYBOARD
5. COPYBOARD COVER LATCH
6. GROUND GLASS
7. DUAL RANGE TIMER
8. VACUUM CONTROL SWITCH
9. VACUUM FILM HOLDER
10. VACUUM PUMP
11. LEVELING LEGS
12. PERCENTAGE FOCUSING SCALES
13. CRANK FOR FRONT CASE MOVEMENT
14. FRONT CASE LOCK
15. CRANK FOR COPYBOARD MOVEMENT
16. COPYBOARD LOCK
17. LAMP ARM
18. LENSBOARD MOVEMENT CONTROLS
19. COPYBOARD POSITION LATCH

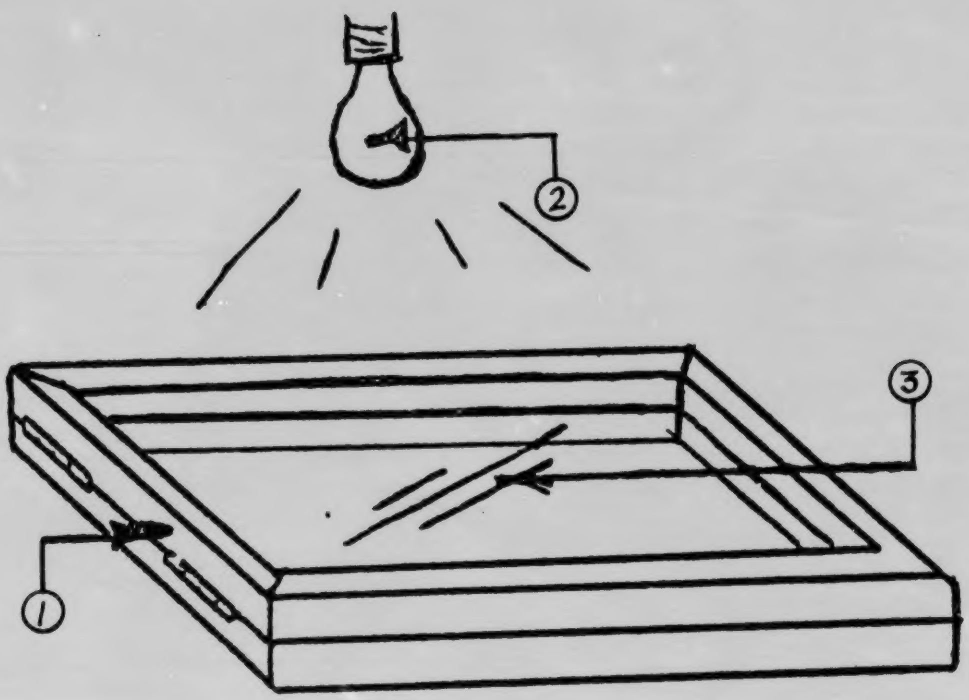
1. Operate only with the teacher's permission and after instructions have been received.

2. To prevent severe burns, do not touch hot process camera lights.

3. Avoid flashing lights in pupils' eyes. Do not look into the lights on the camera.

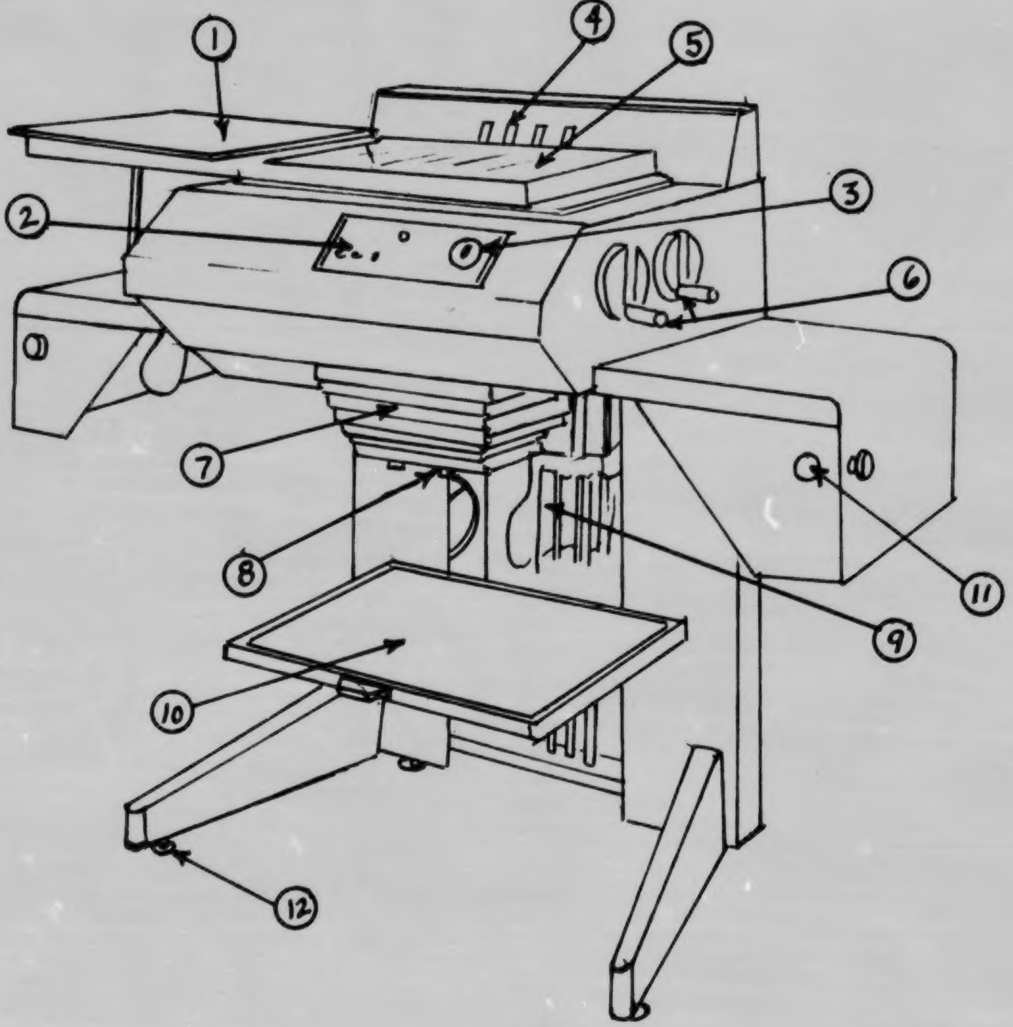
4. Exercise caution when working around the glass copyboard to be sure it is not dropped or broken.

CONTACT PRINTER



1 Frame
2 Light source
3 Glass

VERTICAL PROCESS CAMERA



1 Vacuum film holder

2 Control Panel

3 Dual range timer

4 Percentage scales

5 Ground glass

6 Handles for lens and copyboard movement

7 Bellows

8 Lens

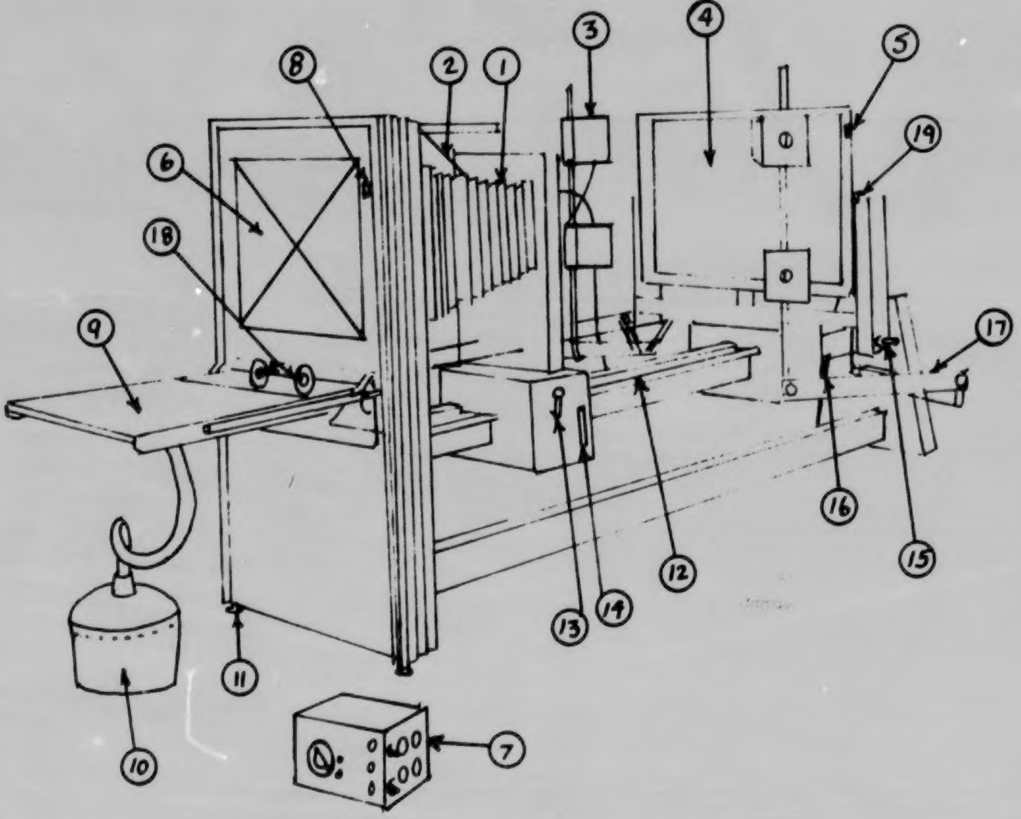
9 Screw drive

10 Copyboard

11 Copyboard light angle adjustment

12 Leveling legs

HORIZONTAL PROCESS CAMERA



1 Bellows
2 Bellows support
3 Quartz lights
4 Copyboard
5 Copyboard cover latch
6 Ground glass
7 Dual range timer
8 Vacuum control switch
9 Vacuum film holder
10 Vacuum pump
11 Leveling legs
12 Percentage focusing scales
13 Crank for front case movement
14 Front case lock
15 Crank for copyboard movement
16 Copyboard lock
17 Lamp arm
18 Lensboard movement controls
19 Copyboard position latch

DARKROOM SAFETY QUIZ

NAME ______________________________

CLASS _____________________________

DATE _______________ GRADE __________

T F 1. Hands should be carefully washed with soap and water after a person has used chemicals.

T F 2. Hands are to be kept away from the face when working in the darkroom.

T F 3. Process camera lights become very hot during use.

T F 4. Electrical devices in the darkroom should be operated with wet hands.

T F 5. Many photographic chemicals are poisonous and/or caustic and may cause skin rashes, irritation, or other health problems.

T F 6. Water temperature control units in the darkroom may be operated by pupils.

T F 7. The ventilator fan should always be left turned on as long as anyone is working in the darkroom.

T F 8. Pupils may change burned-out safelight bulbs.

T F 9. All loose clothing and long hair must be secured when one is operating the color drum processor.

T F 10. The light on the process camera is not bright enough to be dangerous to the eyes.

T F 11. Plastic or rubber gloves will usually provide the needed protection to people who may suffer allergic skin reactions to certain photographic chemicals.

T F 12. A person who is raising the enlarger head should check to see if there is proper clearance for the safelight.

T F 13. The brake/locking mechanism should not be released before raising or lowering the enlarger head.

T F 14. One should make sure his/her head is out of the way before raising or lowering the head of the enlarger.

Multiple Choice:

_____ 15. Splashing or spilling chemicals on clothing: (a) may cause skin irritation, (b) may discolor clothing, (c) wastes chemicals, (d) does all of these.

_____ 16. When handling film and paper during developing, use: (a) tongs, (b) rubber gloves, (c) bare hands, (d) either a or b, (e) either b or c.

_____ 17. Any liquids spilled in the darkroom should be: (a) wiped up immediately, (b) reported to the teacher, (c) left for end-of-class clean-up, (d) left for the custodian to clean up.

_____ 18. Electrical equipment or switches must not be used: (a) with wet hands, (b) while standing on a wet floor, (c) unless wearing rubber gloves, (d) both a and b, (e) both b and c.

_____ 19. When mixing acids: (a) always pour water into acid, (b) pour acid into water, (c) pour either acid into water or water acid, (d) refrain from mixing acid and water.

_____ 20. Identify the contents of bottles by: (a) taste, (b) smell, (c) reading the label, (d) asking another person.

_____ 21. After developing film or prints: (a) wash the hands thoroughly, (b) tell the teacher the work is finished, (c) continue working as usual, (d) leave things out for the next person.

_____ 22. Always replace corks or caps on bottles when finished because this will help: (a) keep the sink area clean, (b) eliminate spilling, (c) keep the contents from evaporating, (d) do all of these.

_____ 23. When preparing chemical solutions, the following protection should be worn: (a) goggles, rubber gloves, and apron, (b) apron and rubber gloves, (c) goggles and rubber gloves, (d) apron and goggles.

_____ 24. Never shake a bottle of strong acid or alkali because: (a) it may spill, (b) it may explode, (c) it may evaporate, (d) it may be dropped.

_____ 25. Chemicals should never be stored: (a) in glass bottles on high shelves, (b) in plastic bottles on low shelves, (c) in glass bottles on low shelves, (d) none of the above.

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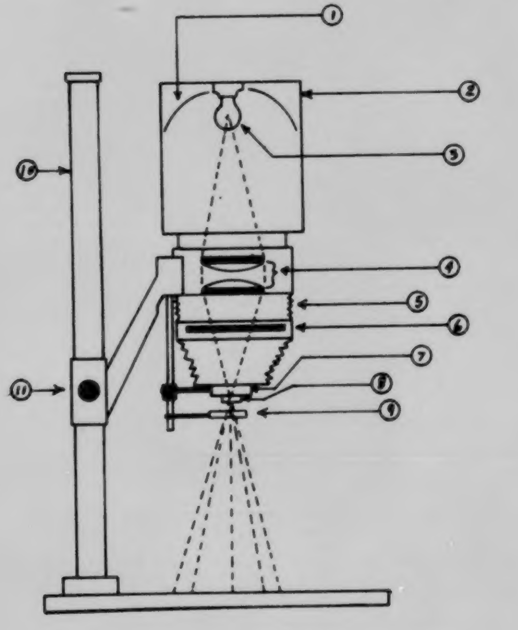
_____ 26. The contact printer should be used: (a) anytime the teacher is in the room, (b) anytime one needs to, (c) only with the teacher's permission, (d) after one has watched others so he/she knows how to operate it.

_____ 27. When loading the contact printer, be careful not to drop or break the: (a) glass, (b) negative, (c) printing frame, (d) none of these.

28. Write the correct name of each machine and its parts in the space provided.



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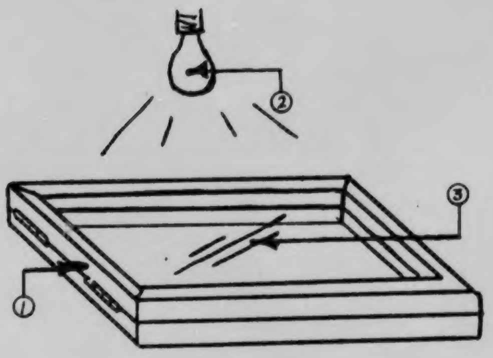

B. ____________________

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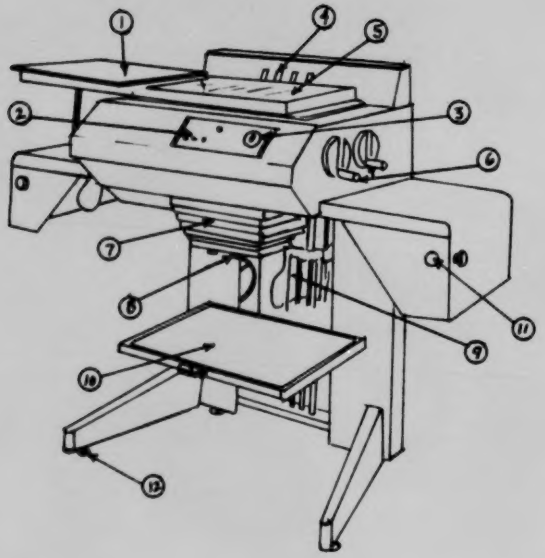
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C.______________________________

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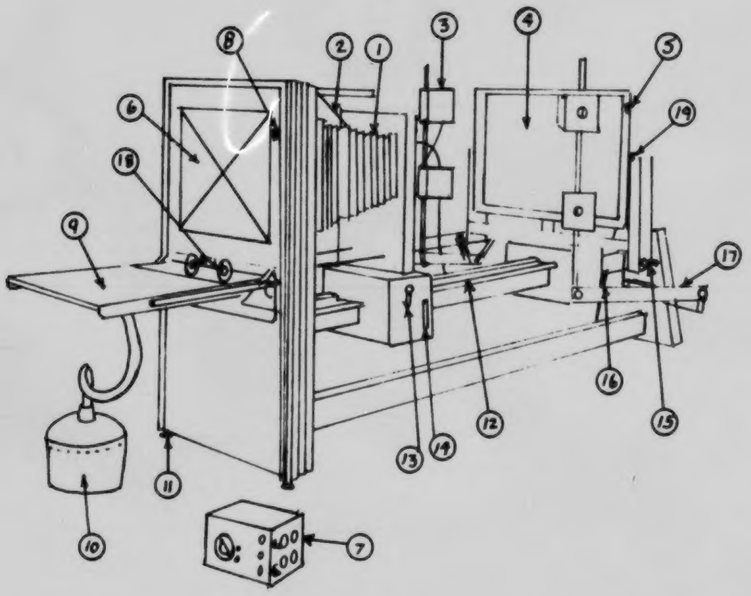
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D. ____________________

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19. ____________________

KEY

1. T
2. T
3. T
4. F
5. T
6. F
7. T
8. F
9. T
10. F
11. T
12. T
13. F
14. T
15. A
16. D
17. A
18. D
19. A
20. C
21. A
22. D
23. A
24. B
25. A
26. C
27. A

28. Parts identification

A. Enlarger
  1. Reflector
  2. Lamp housing
  3. Lamp
  4. Condenser
  5. Bellows
  6. Negative carrier
  7. Lens board
  8. Lens
  9. Filter
  10. Post
  11. Vertical adjustment

B. Contact printer
  1. Frame
  2. Light source
  3. Glass

C. Vertical process camera
  1. Vacuum film holder
  2. Control panel
  3. Dual range timer
  4. Percentage scales
  5. Ground glass
  6. Handles for lens and copyboard movement
  7. Bellows
  8. Lens
  9. Screw drive
  10. Copyboard
  11. Copyboard light angle adjustment
  12. Leveling legs

D. Horizontal process camera
  1. Bellows
  2. Bellows support
  3. Quartz lights
  4. Copyboard
  5. Copyboard cover latch
  6. Ground glass
  7. Dual range timer
  8. Vacuum control switch
  9. Vacuum film holder
  10. Vacuum pump
  11. Leveling legs
  12. Percentage focusing scales
  13. Crank for front case movement
  14. Front case lock
  15. Crank for copyboard movement
  16. Copyboard lock
  17. Lamp arm
  18. Lensboard movement controls
  19. Copyboard position latch

PHOTOGRAPHY EQUIPMENT

1. Obtain the teacher's permission before leaving class on a photography assignment.
2. Secure permission of models and owners of private property before taking photographs.
3. When taking a picture from a car, pull to the edge of the road, stop the car, and put on the brake before beginning to photograph.
4. Never place oneself or one's model in danger when taking a photograph.
5. Treat the camera with care. Do not drop it or place it where it may get banged against solid objects.
6. Do not leave cameras and film in closed cars. They may become superheated by the summer sun.
7. Before mounting a camera on a tripod, be sure the tripod legs are secure.
8. Never ask a model to look directly into the sun or other bright light.
9. Do not set up foolhardy or dangerous pictures. The photographer is in charge of a photography session and should keep things under control.
10. Be sure to take the necessary training in diving techniques before attempting any underwater photography.

FLASH UNITS

1. Electrical contacts in the camera and the flash unit are to be kept clean. Use a rough cloth or a pencil eraser to clean them before using each new roll of film.
2. Be sure the photoflash batteries are fresh. Alkaline batteries are recommended for their long life and short recovery time. However, units that have unplated brass or copper electrical contacts should use zinc carbon batteries.

3. Use a lamp ejector to eject the spent bulbs. Do not pull the bulbs out by hand. They may break in the hand or foul the fittings.

4. Handle the flashbulbs carefully. Slight cracks may cause the bulb to shatter when fired.

5. Insert the first bulb in a series with the cord or the flash unit disconnected from the camera. If the flashbulb is inserted into a live socket, it may go off in the hand, causing cuts and/or burns if the glass shatters.

6. Always have the flash unit aimed away from oneself and others when connecting it. Several conditions may cause the unit to fire into the eyes as it is connected.

7. Always use a flashguard over the flash unit. Occasionally, flashbulbs shatter. A flashguard will protect both the photographer and subjects.

8. Never allow the flash unit to go off in an explosive atmosphere. Also, do not use flash equipment where there are volatile fumes, such as gasoline, etc.

9. Do not handle the flashbulbs immediately after firing. They are extremely hot and can burn. Use the ejector to eject the spent bulbs into a waste container (when they are cool).

10. Never drop freshly-fired bulbs into a container with new bulbs. The new bulbs may ignite.

11. Fire the flashbulbs only at the recommended voltage. Do not fire the flashbulbs with household current unless they are designed for such use.

12. Do not carry loose bulbs in a pocket or bag. Friction may break or ignite them.

SLIDE PROJECTORS AND MOVIE PROJECTORS

1. Be careful when using projector light bulbs. They become very hot can cause burns.

2. Be careful not to catch the fingers in the moving gears of the projector.

3. Disconnect the power cord before opening the case to change a burned out light bulb.

4. When changing a bulb one should be very careful not to crack the bulb and thus cut oneself.

5. Do not put the fingers near moving take-up reels of film, as severe cuts may result.

6. Do not let the projector light shine directly into the eyes of the audience.

7. When using a projector, do not lower the room light so much that the audience could not see to leave in an emergency.

8. Be careful the audience does not trip over extension cords running to the projector.

9. Be sure the projector is set on a solid surface where it will not fall.

10. When the projector session is finished, disconnect power cords and extension cords as soon as possible in order to prevent tripping. Then roll them up neatly and put them away.

STROBE LIGHTS

1. Know how to operate strobe equipment before using it.

2. Be extremely careful not to touch any hot parts.

3. Do not operate strobe lights with a frayed or damaged cord. If an extension cord is necessary, be sure it has suitable amperage rating.

4. Always unplug strobe equipment from the electrical outlet when it's not in use.

5. Let the equipment cool completely before storing it away.

CAMERAS, FLASH UNITS, PROJECTORS SAFETY QUIZ

NAME______________________________________

CLASS______________________________________

DATE____________________GRADE________________

True-False:

T F 1. Get permission of models and owners of private property before taking photographs.

T F 2. Before mounting a camera on a tripod, be sure the tripod legs are secure.

T F 3. Carefully remove used flashbulbs from the camera by hand.

T F 4. Leaving cameras and film in closed and locked cars in the summer is a safe thing to do.

T F 5. Do not exercise any special care in the handling of flashbulbs. They are sturdy.

T F 6. Before beginning a slide show or movie, be sure the projector is on solid surface where it will not fall.

T F 7. Carry both used and unused flashbulbs in a pocket.

T F 8. Use a flashguard over the flash unit at all times, in case a flashbulb shatters.

T F 9. Take no special care of the projector's moving parts.

Multiple Choice:

_____10. When taking a photograph, never endanger: (a) oneself, (b) the model, (c) the camera, (d) both a and b.

_____11. Before leaving the classroom to take photographs: (a) tell another pupil of one's destination, (b) get the teacher's permission, (c) put on a jacket, (d) invite a good friend to go along.

_____12. When taking a photograph from a car: (a) pull to the edge of the road and stop the car, (b) roll down the window, (c) drive slowly while taking the picture, (d) keep one hand on the steering wheel.

_____13. Never ask a model to look directly into: (a) the camera, (b) the sun, (c) empty space, (d) none of these.

_____14. When connecting the flash unit to the camera, always have it aimed: (a) toward one's face, (b) toward the model, (c) toward bystanders, (d) away from oneself and others.

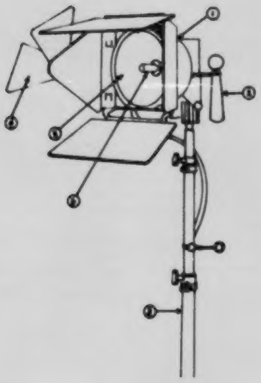
_____15. When changing a burned-out projector bulb: (a) let the bulb cool first, (b) disconnect the power cord, (c) be careful not to crack the bulb, (d) do all of these.

_____16. To protect the members of the audience during a movie or slide show: (a) do not let the projector light shine directly into their eyes, (b) do not have the room so dark a person could not see to leave if necessary, (c) be sure no one trips over extension cords running to the projector, (d) do all of these.

KEY

1. T
2. T
3. F
4. F
5. F
6. T
7. F
8. T
9. F
10. D
11. B
12. A
13. B
14. D
15. D
16. D

PHOTOGRAPHIC STUDIO LIGHTING EQUIPMENT



1. BRIGHTNESS CONTROL (NOT SHOWN)
2. TILTING HANDLE
3. TRIPOD STAND
4. BARN DOOR LIGHT FRAME
5. REFLECTOR
6. QUARTZ BULB

STUDIO LIGHT

1. Do not handle any power cords or switches with damp hands or while standing on a damp floor.

2. Be sure that all electrical cords and connectors are in good condition before connecting them to the source of power. Tell the teacher immediately if frayed cords are found.

3. Exercise extreme caution with lighting hazards. The total of all photo lamps connected to a single household circuit should not exceed 1500 watts. Consult an electrician or electrical supply store before setting up a home studio.

4. When raising or lowering the lighting units, use extreme caution in securing the locking devices in order to avoid serious injury.

5. When working with the boom lighting units, use extreme caution to prevent injury from the heavy counter balance units, and the possibility of a unit falling on another person.

6. Use caution when handling or moving spotlights. The housings become extremely hot after a few minutes of operation. Also the bulb life is greatly decreased when the spotlights are moved while they're still hot.

7. Do not place any floodlight reflector or spotlight head directly on the floor of the studio.

8. Take care not to place flammable screen materials too close to, or in direct contact with, hot lighting equipment.

9. Do not touch any hot lamp with the bare hands or splash any liquid on a hot lamp.

10. After using lighting units, lower all the heads to the lowest possible position, coil the electrical cords, and secure them to the light stand.

11. Be sure all props are firmly secured so they will not fall on models.

12. Tape down any temporary power cords running across the floor so no one will trip over them.

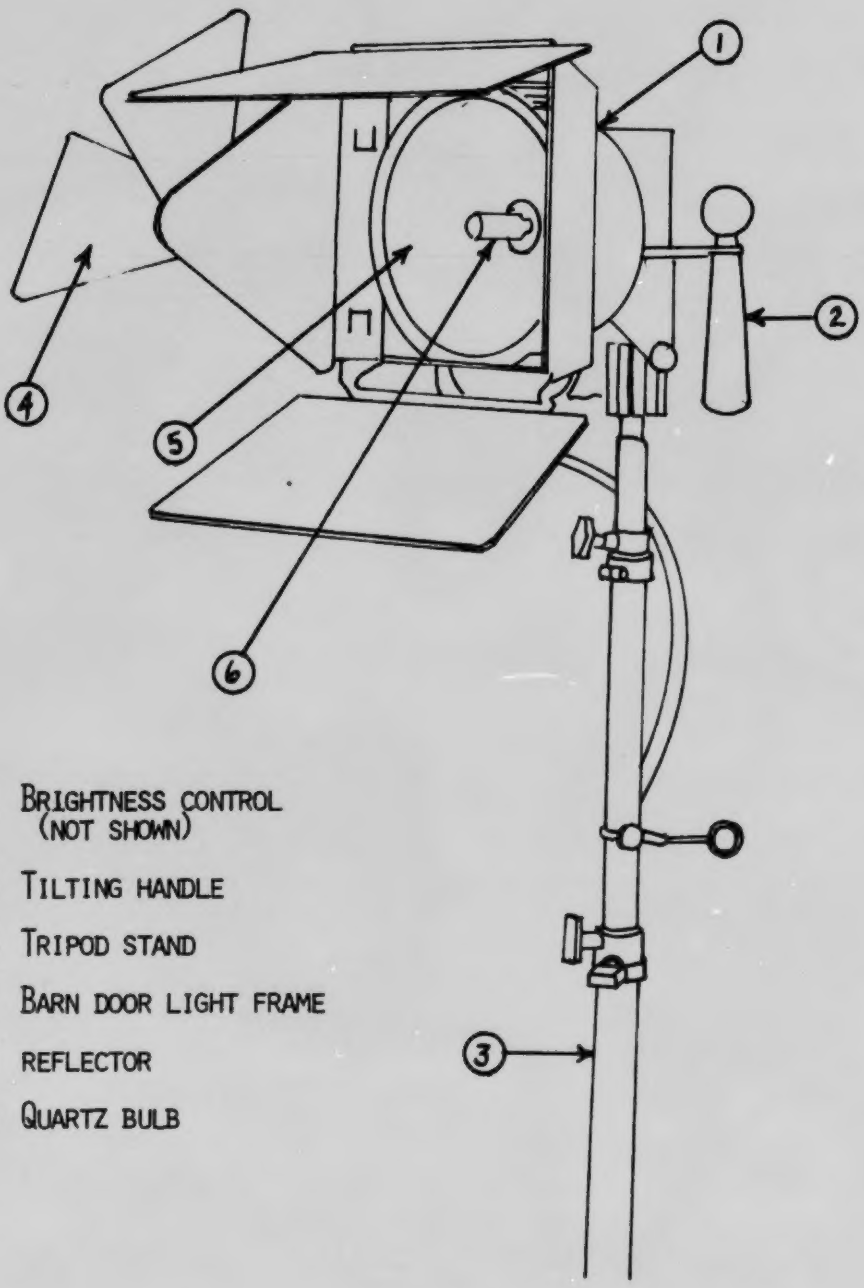
13. Place all studio lighting in such a way that the models do not look directly into the bright lights.

14. To protect the model, never adjust the boom light with the model in place. Always be sure the wing nuts and locks are tightened securely.

15. To adjust boom lights, two pupils are necessary; one to hold and balance the light, and one to tighten the wing nuts securely.

16. To prevent tripping, return all extension cords and electrical equipment to the proper storage place after each use.

STUDIO LIGHT



1 BRIGHTNESS CONTROL (NOT SHOWN)

2 TILTING HANDLE

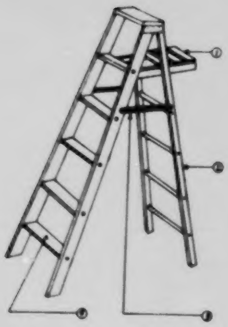
3 TRIPOD STAND

4 BARN DOOR LIGHT FRAME

5 REFLECTOR

6 QUARTZ BULB

LADDERS



1. TOOL SHELF
2. BRACE SIDE OF LADDER
3. SPREAD BRACE
4. FOOT TREADS

1. When shooting high camera angles, always stand on a ladder, not on a chair or a stool. Be very careful when using ladders. If a ladder has any broken parts, report it at once to the teacher.

2. Before climbing a stepladder to adjust studio lights or take high angle photographs, be sure that the feet of the stepladder are placed firmly on a solid floor, that the ladder is fully open, and that both spread braces are in position. The ladder must be OSHA approved.

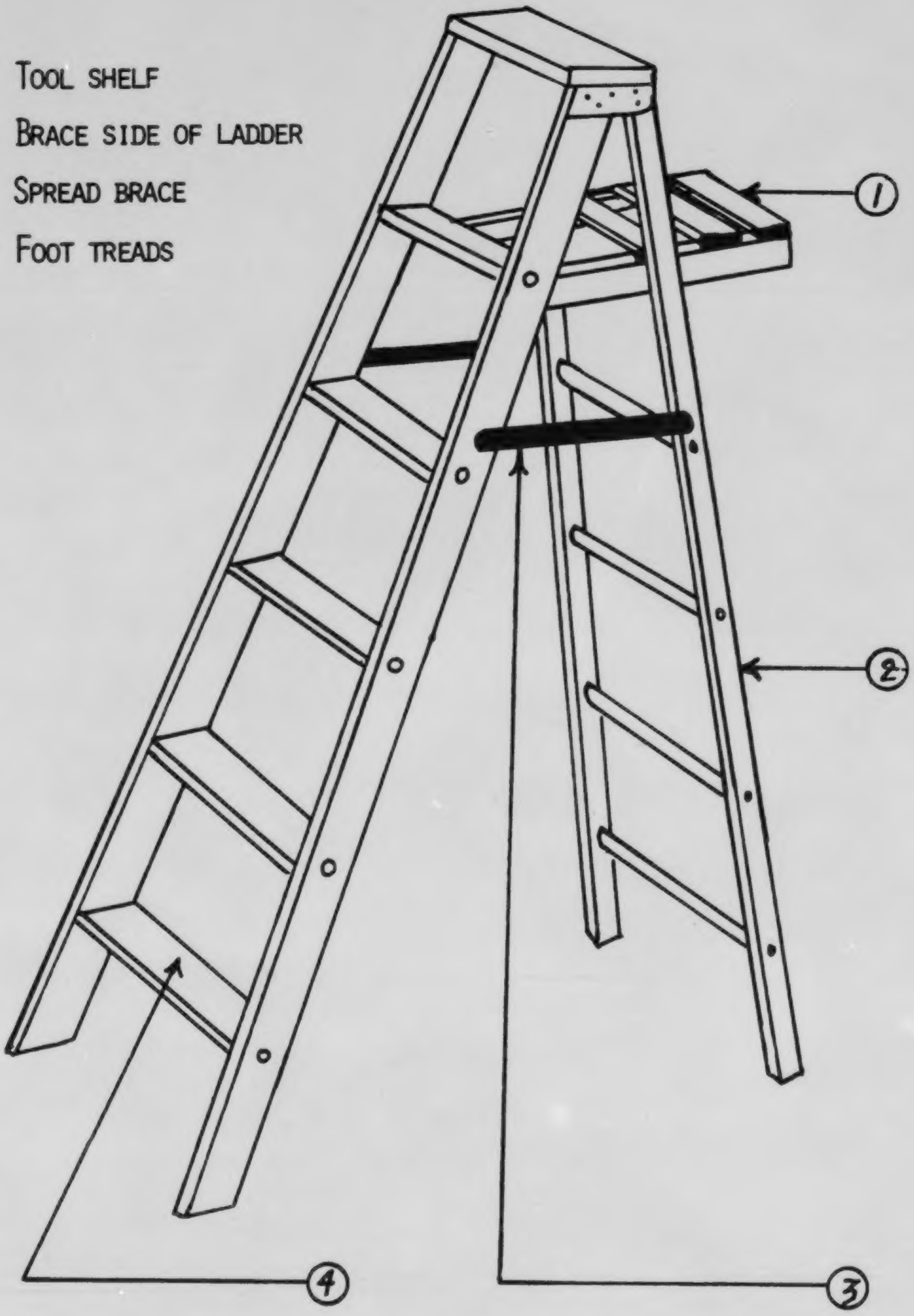
3. Always climb on the tread side of the stepladder, never on the brace side. Never climb higher than the third rung from the top of the ladder.

4. When using a tall ladder, get someone to steady the ladder.

5. Never climb a closed stepladder leaning against a wall or similar surface.

LADDERS

1 Tool shelf
2 Brace side of ladder
3 Spread brace
4 Foot treads



Photographic Studio Safety Quiz

Name ______________________________

Class ______________________________

Date _____________ Grade __________

True-False:

T F 1. Frayed electrical cords may be used when setting up studio lighting, if they are the only ones available.

T F 2. Spotlights become only slightly warm during use.

T F 3. It is all right to handle power cords or switches with damp hands if the electrical equipment is properly grounded.

T F 4. Hot lighting equipment should never be placed close to flammable materials because it could cause a fire.

T F 5. Any temporary power cords running across the floor should be taped to the floor to prevent tripping.

Multiple Choice:

______ 6. The total of all photo lamps connected to a single household circuit should not be more than: (a) 50 watts, (b) 500 watts, (c) 1000 watts, (d) 1500 watts.

______ 7. Do not splash any liquid on a hot lamp or spotlight because: (a) the bulb may shatter, (b) the bulb will get wet, (c) it will make a mess, (d) the liquid is being wasted.

______ 8. After use, all light cords should be: (a) coiled and secured to the light stand, (b) coiled and placed on the floor, (c) left plugged into studio outlets, (d) left taped to the floor.

______ 9. Be sure all props are firmly secured so they don't fall on the: (a) photographer, (b) camera, (c) model, (d) floor.

______ 10. When adjusting studio boom lights: (a) only one pupil is needed, (b) two pupils are needed--one to hold the light and one to tighten the wing nuts, (c) three pupils are needed--two as in (b) above and one to give directions, (d) let everyone help.

______ 11. When shooting high camera angles, stand on a: (a) chair, (b) stool, (c) ladder, (d) box.

______ 12. In the studio, always keep one leg of the light and camera tripods pointing: (a) towards the model, (b) towards the camera, (c) away from the model, (d) away from the camera.

______ 13. After use, extension cords and electrical equipment should be: (a) returned to storage, (b) pushed into a corner, (c) left in place for the next assignment, (d) none of these.

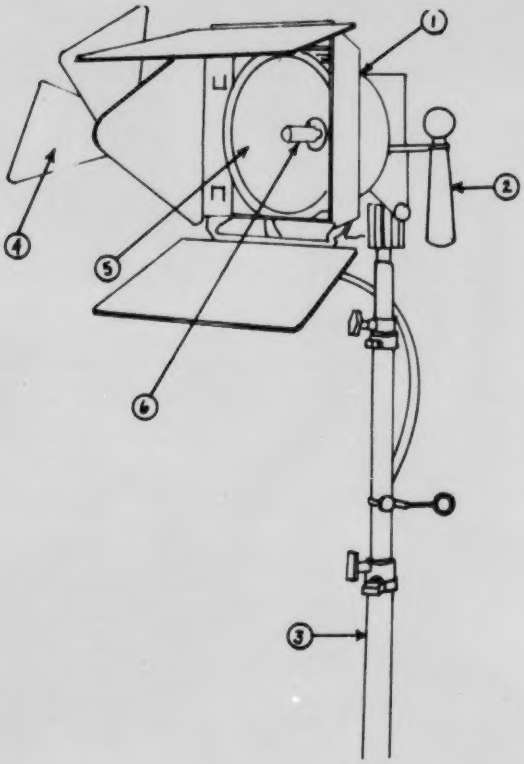
______ 14. To protect the model: (a) always adjust the boom light with the model in place, (b) never adjust the boom light over the model's head, (c) have the model looking directly into bright lights, (d) do none of these.

______ 15. When climbing a stepladder, use: (a) the brace side, (b) the tread side, (c) the spread brace side, (d) any method at all.

______ 16. When using a stepladder, be sure: (a) one spread brace is in position, (b) both spread braces are in position, (c) neither spread brace is in position, (d) none of these.

______ 17. Before climbing a stepladder, make certain: (a) the feet are firmly placed, (b) the ladder is fully open, (c) the ladder is on a solid floor, (d) all of these.

18. Write the correct name for each item and its parts in the space provided.



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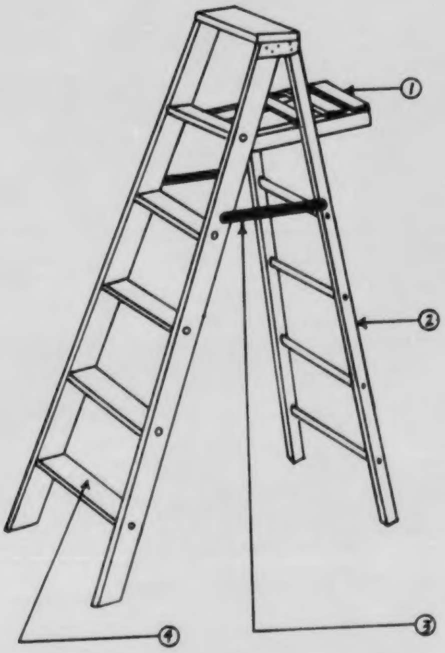

B. ______________________________

1. ______________________________

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3. ______________________________

4. ______________________________

KEY

1. F
2. F
3. F
4. T
5. T
6. D
7. A
8. A
9. C
10. B
11. C
12. A
13. A
14. B
15. B
16. B
17. D
18. Parts identification

   A. Studio light

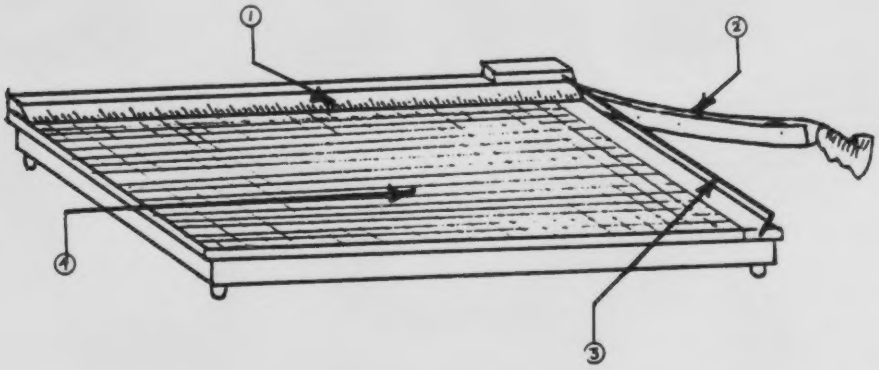
      1. Brightness control
      2. Tilting handle
      3. Tripod stand
      4. Barn door light frame
      5. Reflector
      6. Quartz bulb

   B. Ladder

      1. Tool shelf
      2. Brace side of ladder
      3. Spread brace
      4. Foot treads

FINISHING EQUIPMENT

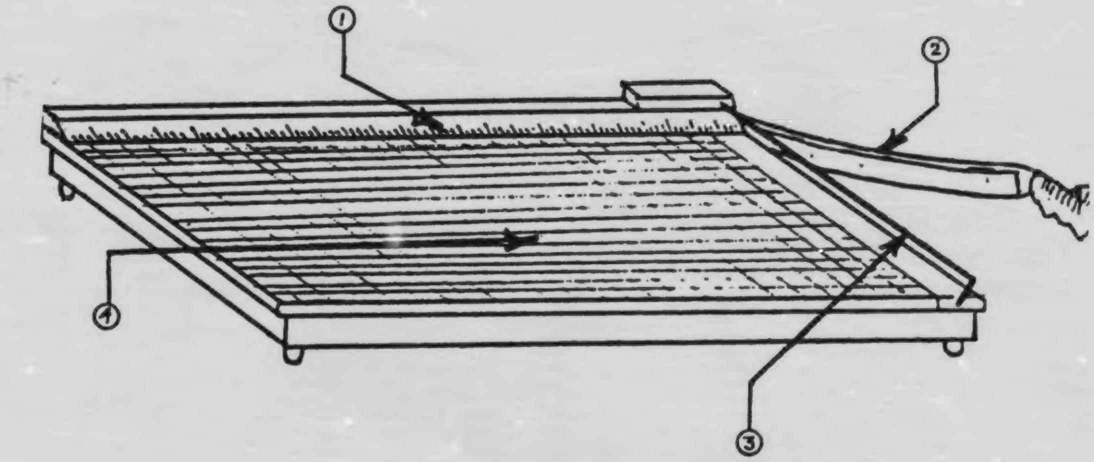
HAND-OPERATED PAPER CUTTER



1. SCALE OF INCHES
2. KNIFE
3. GUARD
4. PAPER TABLE

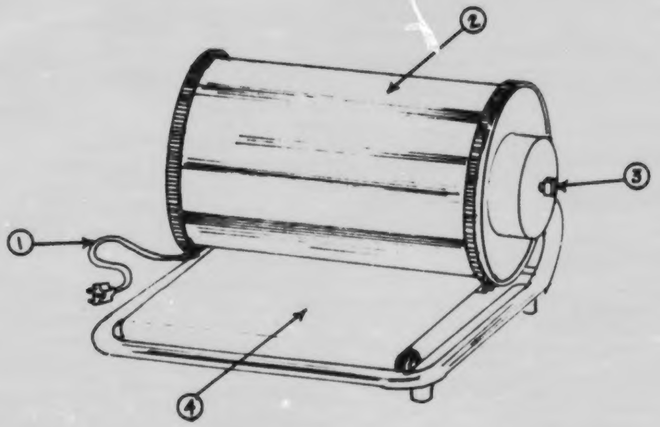
1. Operate only with the teacher's permission and after instructions have been received.
2. Use the paper cutter with great care as it can cause serious cuts and pinches.
3. When operating the paper cutter, keep the fingers behind the safety guard and never remove the guard.
4. To prevent cut fingers, use the safelight when cutting orthochromatic film in the darkroom. For cutting panchromatic film in total darkness, the cutting edge should be coated with fluorescent or luminescent paint.
5. Place a ruler, not the fingers, next to the blade to hold the paper flat.
6. When using the paper cutter, cut only one sheet of paper or film at a time. Do not use the paper cutter to cut anything except paper or film.
7. When finished, always close the cutting blade and fasten it with the safety lock.

HAND-OPERATED PAPER CUTTER



1 Scale of inches
2 Knife
3 Guard
4 Paper table

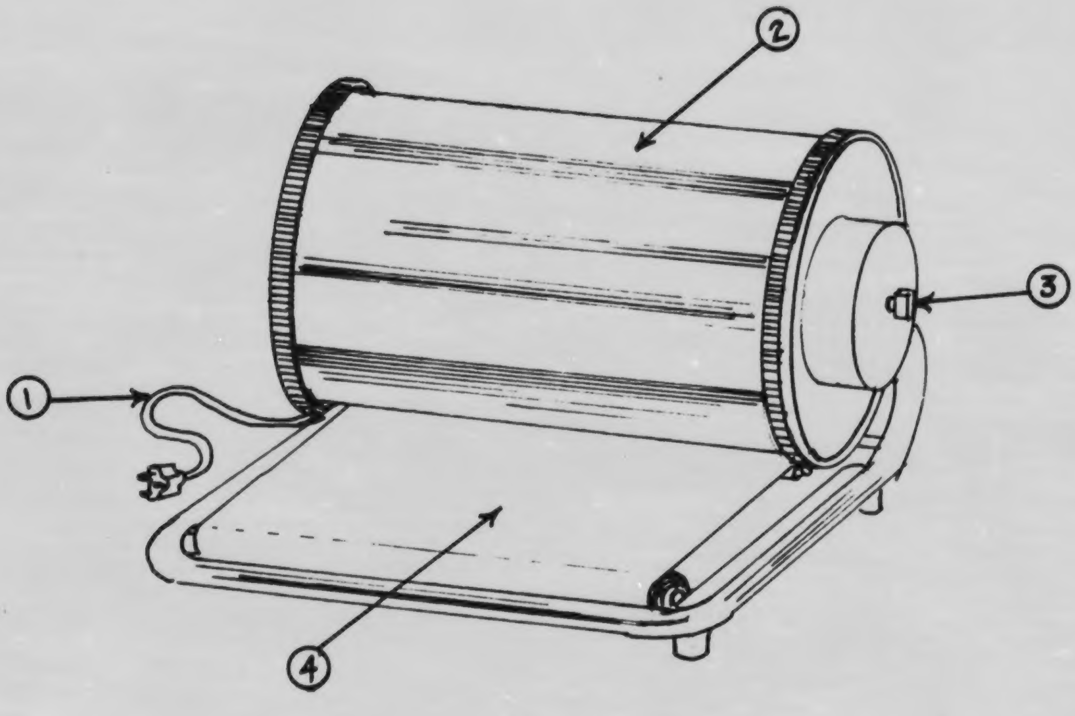
PRINT DRYER



1. POWER CORD
2. FERROTYPE TIN
3. THERMOSTAT
4. CANVAS COVER

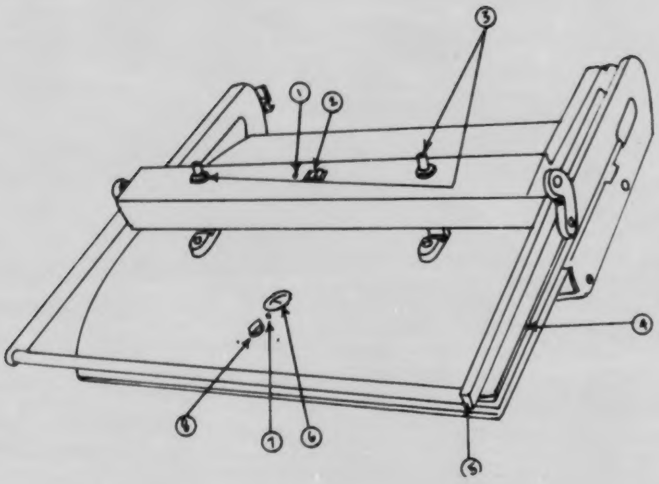
1. Operate only with the teacher's permission and after instructions have been received.
2. Be careful to avoid burns when using the print dryer. Its surfaces are hot.
3. Be sure the electrical cord to this machine is not worn and is properly grounded.
4. Do not use this machine with wet hands of while standing on a wet floor.

PRINT DRYER



1 Power cord
2 Ferrotype tin
3 Thermostat
4 Canvas cover

DRY MOUNT PRESS



1. POWER LIGHT(RED)
2. ON/OFF SWITCH
3. PRESSURE ADJUSTMENT KNOBS
4. SPONGE PAD
5. HANDLE
6. THERMOMETER
7. PILOT LIGHT(AMBER)
8. THERMOSTAT

1. Operate only with the teacher's permission and after instructions have been received.

2. When using the dry mount press or tacking iron, pupils should be careful not to burn themselves.

3. Never test the heat of the press or tacking iron by touching.

4. Do not let the hands come into contact with the platen of the dry mount press. Also, do not close the press on the hands.

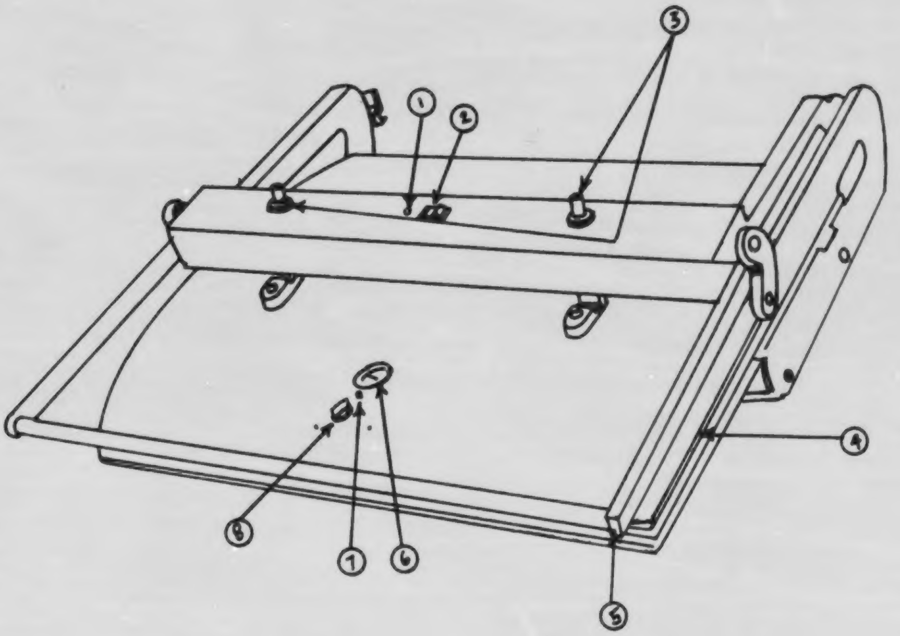
5. Dry mount with the heat setting prescribed by the teacher.

6. Do not lay the hot tacking iron down on papers or the counter top. Return it to its proper holder after each use.

7. When closing the platen of the dry mount press, be sure that the print and the mount are the only items under the platen.

8. Turn off and unplug the press or tacking iron when the job is finished.

DRY MOUNT PRESS



1	Power light (red)	5	Handle
2	On/off switch	6	Thermometer
3	Pressure adjustment knobs	7	Pilot light (amber)
4	Sponge pad	8	Thermostat

SPRAY ADHESIVES AND FILM CLEANERS

1. Get instructions on how to use these materials properly and safely before proceeding.
2. Use spray adhesives and film cleaners in a well-ventilated place. They are flammable.
3. Avoid breathing the fumes. There is evidence that these fumes can seriously damage one's health.
4. Do no use these materials in areas where others will have to breathe the fumes.
5. Treat these substances just like any other flammable material would be treated.

CUTTING TOOLS

1. Use all cutting tools (scissors, X-acto knives, matte knife, etc.) very carefully.
2. Keep all cutting tools sharp since dull blades can be dangerous.
3. Carry and store all cutting tools in a safe manner.
4. To prevent serious cuts, never try to catch a dropped cutting tool.

FINISHING EQUIPMENT SAFETY QUIZ

NAME________________________________

CLASS________________________________

DATE_______________GRADE______________

True-False:

T F 1. The guard should be removed before using the paper cutter.

T F 2. The paper cutter may also be used to cut cloth, plastic, and thin pieces of wood.

T F 3. The tacking iron must be returned to its proper holder after use to avoid fire danger or damage to the counter.

T F 4. The heat setting for the dry mount press is to be decided by teacher.

T F 5. Spray adhesives and film cleaners are flammable and special precautions should be taken when using them.

T F 6. The print dryer becomes only slightly warm during use.

T F 7. The paper cutter can cause serious cuts and pinches.

T F 8. A person using the paper cutter should cut several pieces at one time to save energy and time.

T F 9. The print dryer should not be used with wet hands or while standing on a wet floor.

Multiple Choice

_____10. For cutting panchromatic film in total darkness, the cutting edge of the paper cutter should be coated with: (a) luminescent paint, (b) fluorescent paint, (c) latex paint, (d) a or b above.

_____11. When using spray adhesives or film cleaners, be sure to: (a) avoid breathing the fumes, (b) store them in a metal cabinet, (c) avoid using them around sparks or flames, (d) do all of these.

_____12. When using the tacking iron or dry mount press, extreme care should be taken due to: (a) the plug-in of the equipment, (b) the style of the equipment, (c) the high temperature of the equipment, (d) none of these.

_____13. Before using the paper cutter, the pupil should: (a) put on safety glasses, (b) have the teacher's permission, (c) tie back long hair, (d) tuck in loose clothing.

_____14. When the paper cutter is not in use, the blade must be: (a) closed and locked, (b) open and locked, (c) closed and unlocked, (d) open and unlocked.

_____15. When using the dry mount press, keep the hands away from: (a) the base, (b) the matte, (c) the platen, (d) the mount.

_____16. To avoid burns, always draw the tacking iron away from: (a) the print edge, (b) the mount board, (c) the hand, (d) the print center.

_____17. In order to hold paper flat when using the paper cutter, use: (a) the left hand, (b) a ruler, (c) the right hand, (d) a piece of cardboard.

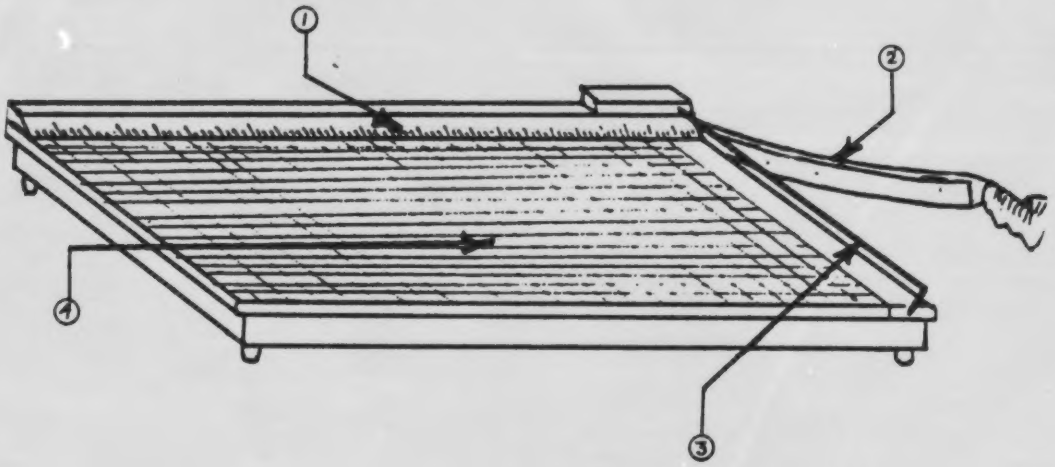
_____18. When using the paper cutter, cut the following number of sheets of paper at one time: (a) one, (b) two, (c) three, (d) five.

_____19. When closing the platen of the dry mount press, the only two things under the platen should be: (a) the print and tape, (b) the print and mount, (c) the mount and protective shield, (d) the mount and tape.

_____20. When finished with the dry mount press or tacking iron, always: (a) turn it off and unplug, (b) leave it plugged in for the next pupil, (c) unplug only, (d) turn off only.

21. Write the correct name of each item and its parts in the space provided.

(See next page)

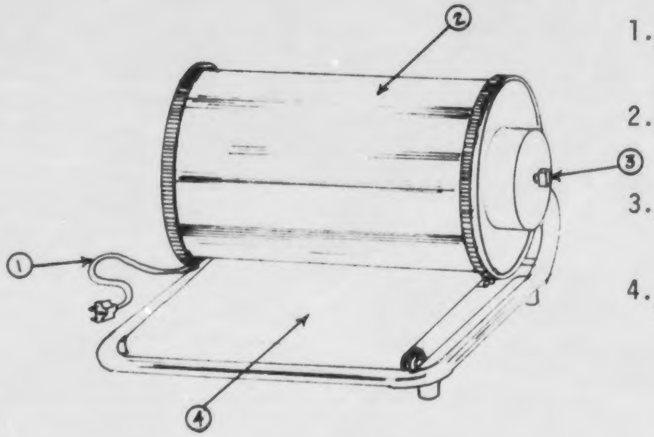


A.____________________________________

1__________________________ 3.__________________________

2.__________________________ 4.__________________________

B.____________________________



1.________________________

2.________________________

3.________________________

4.________________________

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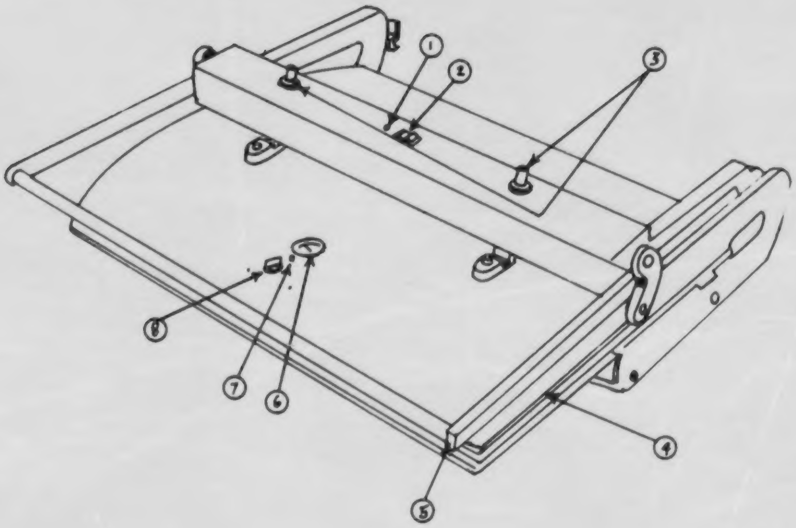


C. ______________________________

1. ____________________

2. ____________________

3. ____________________

4. ____________________

5. ________________________

6. ________________________

7. ________________________

8. ________________________

KEY

1. F
2. F
3. T
4. T
5. T
6. F
7. T
8. F
9. T
10. D
11. D
12. C
13. B
14. A
15. C
16. C
17. B
18. A
19. B
20. A
21. Parts identification

    A. Hand-operated paper cutter
    1. Scale of inches
    2. Knife
    3. Guard
    4. Paper table

    B. Print dryer
    1. Power cord
    2. Ferrotype tin
    3. Thermostat
    4. Canvas cover

    C. Dry mount press
    1. Power light
    2. On/off switch
    3. Pressure adjustment knobs
    4. Sponge pad
    5. Handle
    6. Thermometer
    7. Pilot light
    8. Thermostat

REFERENCES

Materials were selected and reviewed from the following sources, and in some instances were incorporated in the production of the preceding unit.

Accident Prevention for Industrial Arts, Vocational and Technical Education Programs. Oklahoma State Board of Vocational and Technical Education.

California Industrial Arts Safety Instruction Manual. California State Department of Education: Sacramento

Ohio Industrial Arts and Vocational Education Safety Manual. State of Ohio Department of Education.

Pennsylvania Industrial Arts Safety Guide. Industrial Arts Association of Pennsylvania, Pennsylvania Department of Education.

Safety Planning in Graphic Communications Education. Graphic Arts Technical Foundation: Pennsylvania, 1979

Utah Industrial Education Safety Recommendations and UOSHA Standards. Utah State Board of Education.

Washington State Industrial Arts Safety Guide. Washington State Board of Education.

Wichita State University Photography Safety Instructions. Wichita State University: Kansas.

Wyoming Occupational Education Safety Manual. Wyoming State Department of Education: Wyoming, 1973

A. B. Dick Company

Addressograph-Multigraph Corp.

Challenge Machinery Co.

Chandler & Price Co.

Compugraphic

Hammond Machinery Builders, Inc.

Interlake, Inc.

Lowel-Light Manufacturing, Inc.

MacMillan Arts & Crafts, Inc.

Michael Business Machines

Nuarc Company, Inc.

Photo Materials Company

Robertson Photo-Mechanix, Inc.

Screen Printing & Drying Machine Co.

Seal, Inc.

SSP Brown Camera, Inc.

Vivitar Corporation

METALWORKING EQUIPMENT

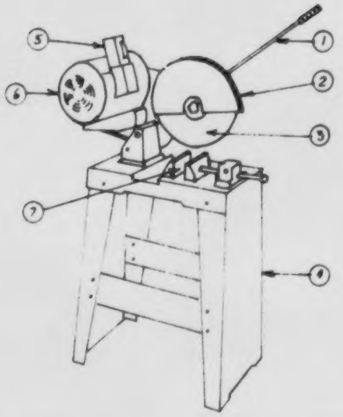
This table is the reported data resulting from an 18-month, 5-state survey published by NIOSH under the title: "Machine Guarding--Assessment of Need," 1975. The table categorizes those hazards that are normally associated with the various metalworking machines.

While the pupil will not be exposed to all of the listed machines during his/her high school experiences, he/she may operate one in industry and should be aware of the potential hazards.

METALWORKING MACHINE HAZARDS

MACHINE TYPE	HAZARD												TOTAL
	Bending	Chemical	Cutting	Electrical	Falling Objects	In-Running Nip Points	Punching/Shearing	Radiological	Reciprocating/Transverse	Rotating	Shattering	Thermal	
1. Mechanical Power Press	x				x		x		x	x		x	6
2. Lathes		x	x		x	x			x	x	x	x	8
3. Grinders		x	x			x			x	x	x	x	7
4. Drillers		x	x						x	x		x	5
5. Millers		x	x		x				x	x		x	6
6. Cut-Off and Sawing		x	x						x	x		x	5
7. Resistance Welders	x	x		x		x		x	x			x	7
8. Press Brakes	x				x				x				3
9. Polishers and Buffers		x								x		x	3
10: Arc Welders	x	x		x				x	x			x	6
11. Borers		x	x						x	x		x	5
12. Power Punch and Shears	x		x				x		x			x	5
13. Hydraulic Press	x	x			x		x		x				5
14. Benders and Formers	x					x				x		x	4
15. Riveters							x		x				2
16. Forge and Hot Metal Stamp	x	x	x		x	x	x	x	x	x		x	10
17. Wire and Metal Ribbon Formers	x					x			x	x		x	5
18. Tappers		x	x						x	x		x	5
19. Forming Rolls and Calenders						x				x		x	3
20. Threaders		x	x						x	x		x	5
21. Gear Cutters and Finishers		x	x							x		x	4
22. Shapers			x						x			x	3
23. Planers			x						x			x	3
24. Honers		x							x	x	x		4
25. Broachers		x	x						x			x	4
26. Lappers		x							x	x	x		4
27. Electrical Discharge Machine		x		x					x			x	4
28. Electrochemical Machine		x		x					x			x	4
29. Electrolytic Grinders		x		x					x	x	x	x	6

ABRASIVE CUT-OFF SAW



1. OPERATING HANDLE
2. WHEEL GUARD
3. ABRASIVE WHEEL
4. STAND
5. SWITCH
6. MOTOR
7. VISE

1. All swing or sliding cut-off saws shall be provided with a hood that will completely enclose the upper half of the saw. (OSHA)

2. Limit stops shall be provided to prevent swing or sliding type cut-off saws from extending beyond the front or back edges of the table (OSHA)

3. Each swing or sliding cut-off saw shall be provided with an effective device to return the saw automatically to the back of the table when released at any point of its travel. (OSHA)

4. A full face shield shall be worn when operating the machine.

5. All safety guards must be in place before starting the machine.

6. The work piece must be held firmly in the vise before starting the machine.

7. The machine should be operated within the rated machine capacity.

8. Cutoff wheels should not be overfed.

9. Cutoff wheels must not be used for grinding.

10. The wheel guard should always be kept in the down position except when changing the wheel.

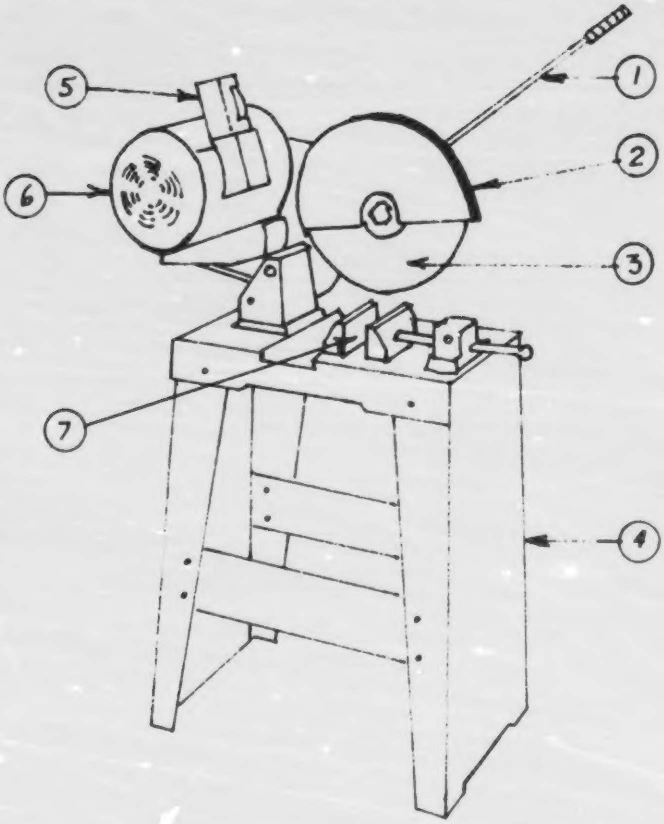
11. Newly mounted wheels should run at operating speed, with the guard in place, for at least one minute before cutting.

12. A person should not stand directly in front of the wheel whenever an abrasive cut-off saw is started.

13. This machine must not be used without specific permission from the teacher.

14. The wheel should be visually inspected before using the abrasive saw.

ABRASIVE CUT-OFF SAW



1 OPERATING HANDLE	5 SWITCH
2 WHEEL GUARD	6 MOTOR
3 ABRASIVE WHEEL	7 VISE
4 STAND	

ABRASIVE CUT-OFF SAW SAFETY QUIZ

NAME ______________________________

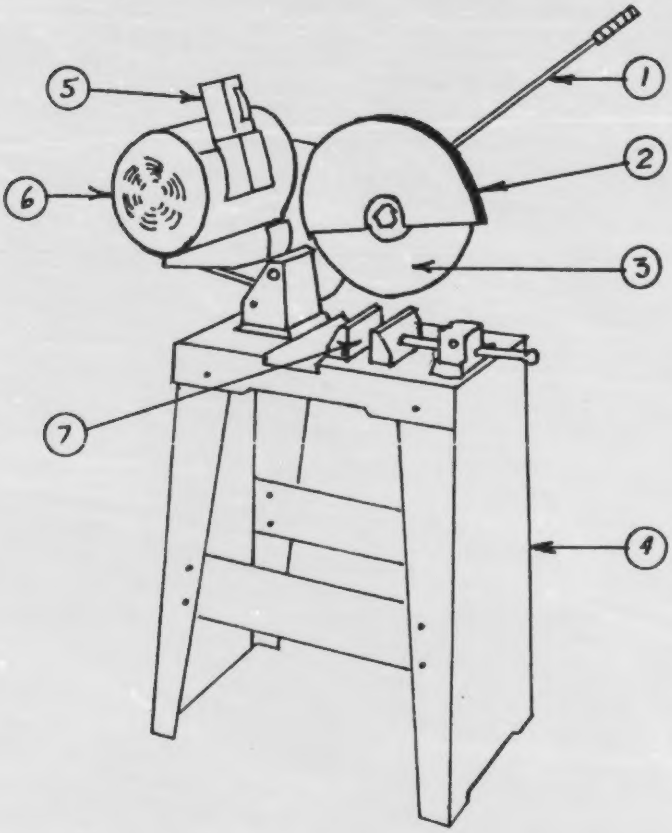
CLASS ______________________________

DATE _______________ GRADE ________

(Circle true or false)

1. The guard must be positioned to cover the upper half of the saw. T F
2. The saw should not be used if it does not automatically return to an up position when released at any point of its travel. T F
3. Safety glasses should be worn when operating the abrasive cut-off saw. T F
4. When cutting large pieces, the work may be held in position by hand. T F
5. New wheels should be allowed to run for at least one minute before using them on a work piece. T F
6. The cut-off wheels should be forced into the work piece slowly, in order not to overfeed. T F
7. The cut-off wheel may also be used for grinding. T F
8. A pupil should check with the teacher before cutting very small pieces of metal. T F
9. Always stand behind the saw when the power is turned on. T F
10. The wheel should be checked for cracks before it is used. T F

In the spaces provided, identify the parts of the abrasive cut-off saw.



1 ____________________

2 ____________________

3 ____________________

4 ____________________

5 ____________________

6 ____________________

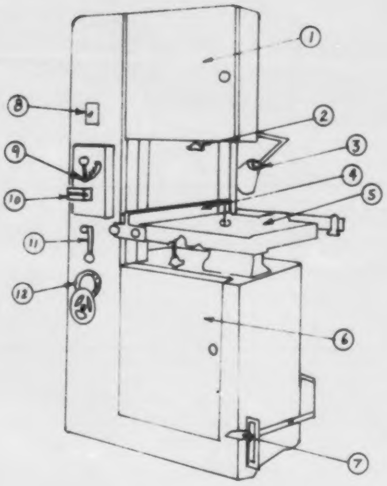
7 ____________________

Signed ____________________
Pupil

____
Teacher

Date: ____________________

BAND SAW



1. UPPER WHEEL COVER
2. TENSION KNOB
3. LAMP
4. FENCE
5. TABLE
6. LOWER WHEEL COVER
7. FOOT BRAKE
8. WELDER SWITCH
9. WELDER SELECTOR
10. WELDING VISE
11. SWITCH
12. SPEED CONTROL

1. A band saw shall be so guarded that the saw blade shall be enclosed (except for the working portion of the blade which is between the bottom of the guide rolls and the table). (OSHA)

2. A guard for the blade on the band saw shall protect the saw blade at the front and outer sides, and this portion of the guard shall be self-adjusting to raise and lower with the guide. (OSHA)

3. All band saws shall be provided with a tension control device to indicate proper tension. (OSHA)

4. Appropriate eye protection shall be worn.

5. A pupil should secure permission from the teacher before cutting large or irregular shaped pieces.

6. Hands and fingers should be kept in such a position that there is no danger of them slipping into the blade. Hold the work piece on either side of the kerf line. Use a push stick where necessary.

7. The machine must not be left until it has completely stopped.

8. Scrap should be removed only when the machine is stopped.

9. The guide and guard should be adjusted to within 1/4 inch of the work.

10. Properly secured and adjusted guards should be used at all times.

11. Jewelry should be removed, loose clothing eliminated, and long hair confined.

12. The work should be guided slowly, letting the machine do the work. Do not force the work into the blade.

13. Avoid backing out of a cut (kerf).

14. Cut only stock which has a flat surface to bear against the table.

15. The material should be held firmly.

16. Waste must not accumulate on the saw table.

17. If the saw breaks or comes off, step away immediately. Shut off the power, if possible. Notify the teacher.

18. The floor should always be kept clean of cuttings, oil, and scrap.

19. Sawed material must be handled with care until all burrs are removed.

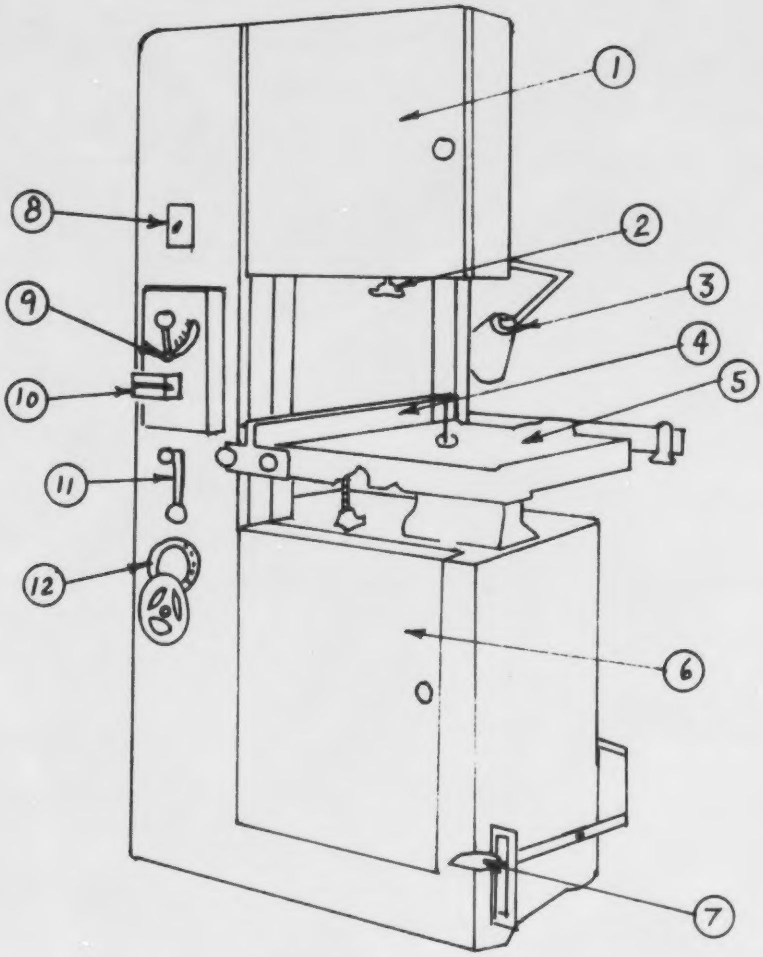
20. Chips should be cleaned off the machine with a brush, not with hands or a rag.

21. Adjustments must never be made until the machine is stopped.

22. The saw must always be operated at speeds in accordance with the type and thickness of the metal being cut.

23. Give undivided attention to the job. The operator should be the only one inside the safety zone area.

BAND SAW



1	Upper wheel cover	5	Table	9	Welder selector
2	Tension knob	6	Lower wheel cover	10	Welding vise
3	Lamp	7	Foot brake	11	Switch
4	Fence	8	Welder switch	12	Speed control

BAND SAW SAFETY QUIZ

NAME ____________________________

CLASS ____________________________

DATE ____________ GRADE ____________

(Circle true or false)

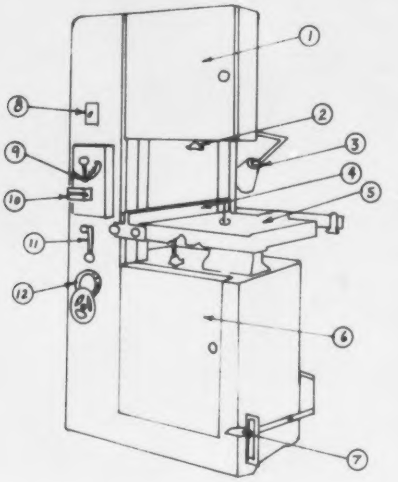
1. The blade guard should be adjusted to about 1/4 inch from the work. T F
2. The blade guides should be tightly adjusted against the blade. T F
3. The teacher's permission is required before one can operate a band saw. T F
4. Adjustments should be made with the power off. T F
5. Eye protection is not required when operating a band saw. T F
6. One should use a brush to remove chips from the table. T F
7. A person should not try to increase the speed of cutting by applying pressure with the hands. T F
8. It is all right to leave the machine as soon as the cut has been finished. T F
9. Scrap should be removed only after the blade has stopped. T F
10. Material should always be held firmly. T F
11. A band saw should be so guarded that the saw blade is enclosed (except for the working portion of the blade which is between the bottom of the guide rolls and the table). T F
12. All band saws will have a tension control device to indicate the proper tension. T F
13. A push stick should never be used on a metal band saw. T F

(Circle true or false)

14. The operator should be the only person inside the safety zone area. T F

15. A rag can be used to clean the table of scraps. T F

In the spaces provided, identify the parts of the band saw illustrated below:



1 ______________________

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5. ______________________

6. ______________________

7 ______________________

8 ______________________

9 ______________________

10 ______________________

11 ______________________

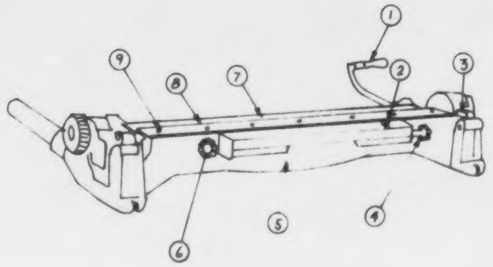
Signed:

____
Pupil

____
Teacher

Date ______________________

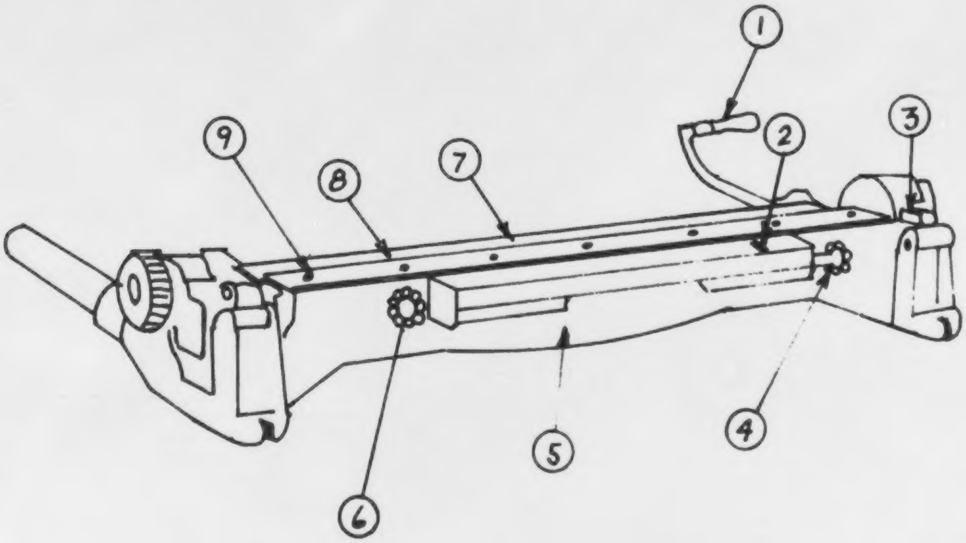
BAR FOLDER



1. OPERATING HANDLE
2. DEPTH GAUGE
3. 45°-90° STOPS
4. DEPTH GAUGE WHEEL
5. BASE
6. LOCK WHEEL
7. WING SET KNOB
8. WING
9. BLADE

1. Remove jewelry, eliminate loose clothing, and confine long hair.
2. Use proper eye protection at all times.
3. Operate only with the teacher's permission, and after instruction has been received.
4. Make sure all guards are in place and operating correctly.
5. Make bends smoothly and steadily.
6. Restore the machine lever to its proper position after each operation.
7. Remove the sharp burrs and edges on sheet metal before folding it.
8. Hold the handle firmly.
9. Keep hands clear of movable parts.
10. Make sure that no one but the operator is inside the operator zone.
11. Let the handle down slowly after completing a bend.
12. Work with only one piece of metal at a time. Never double the thickness or two pieces side by side.
13. Do not force, hit, or drop levers or handles.
14. Fold only a single thickness of sheet metal within the capacity of the bar folder.

BAR FOLDER



1 Operating handle

2 Depth gauge

3 45°-90° stops

4 Depth gauge wheel

5 Base

6 Lock wheel

7 Wing set knob

8 Wing

9 Blade

BAR FOLDER SAFETY QUIZ

NAME ____________________

CLASS ____________________

DATE __________ GRADE ______

(Circle true or false)

1. Sharp burrs and edges should be removed before attempting to place metal in the machine. T F

2. Fingers must be kept clear of moving parts. T F

3. Two pieces of metal can be bent at the same time. T F

4. If a handle becomes stuck in position, tap it lightly with a hammer. T F

5. Safety glasses are not needed on this machine. T F

6. No one but the operator should be in the operator zone. T F

7. The handle should be held loosely. T F

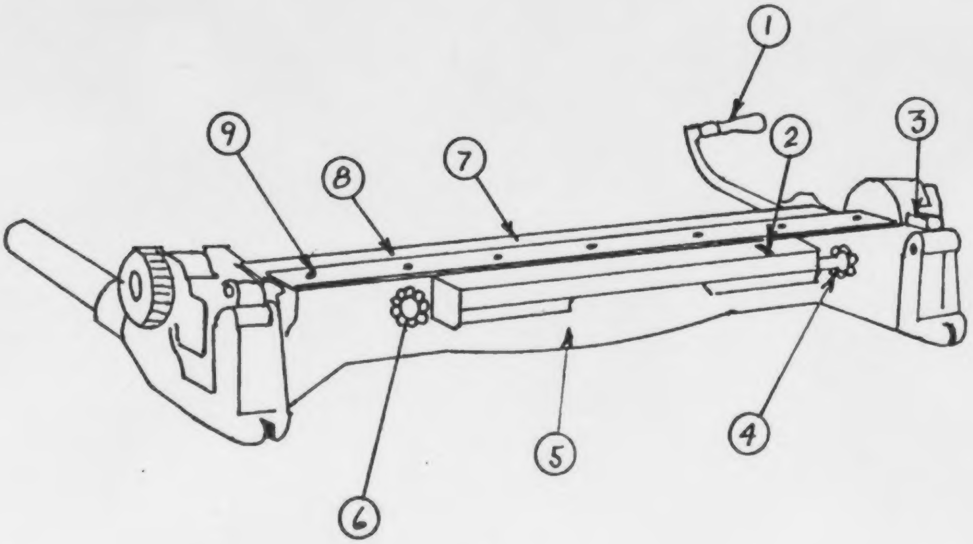
8. Hands must be kept clear of the moving parts of the folder. T F

9. A pupil must secure the teacher's permission before using the folder. T F

10. A person should make bends as fast as he/she can, so the next person can use the folder. T F

11. If a pupil needs to bend a large piece of metal, he/she may remove any safety guards that are in the way of the folder. T F

In the spaces provided, identify the parts of the bar folder:



1 ______________________

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3 ______________________

4 ______________________

5 ______________________

6 ______________________

7 ______________________

8 ______________________

9 ______________________

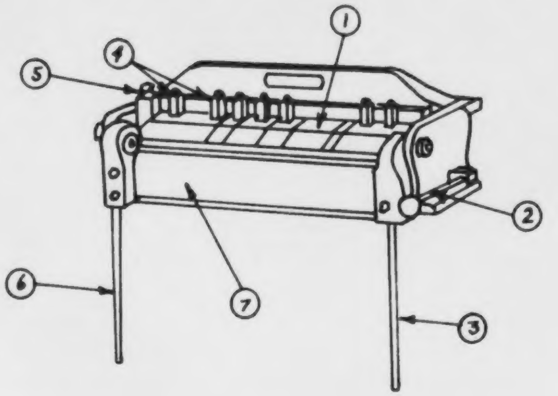
Signed:

____
Pupil

____
Teacher

Date: ______________________

BOX AND PAN BRAKE



1. BLADE SEGMENTS
2. BLADE POSITION HANDLE
3. WING HANDLE
4. BLADE HOLDING BOLTS
5. HEIGHT ADJUSTMENT
6. WING HANDLE
7. WING

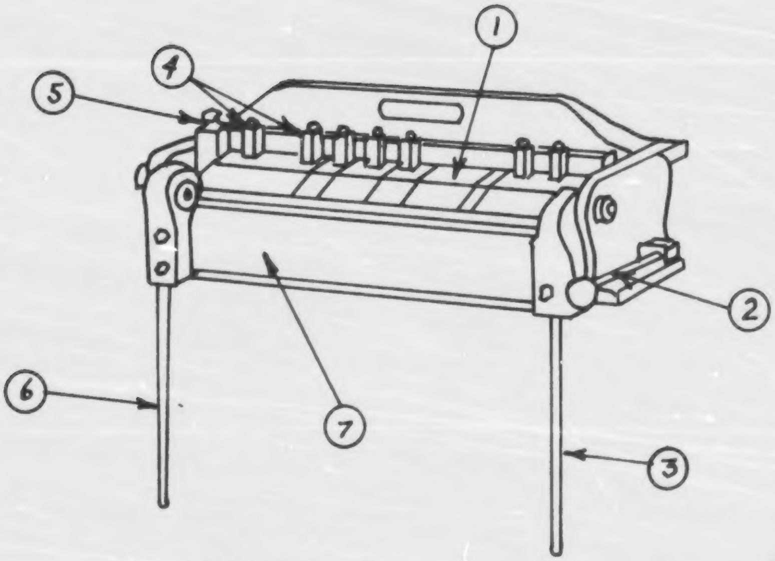
1. Never attempt to operate the brake until instruction has been given.
2. Obtain permission from the teacher before using the brake.
3. Wear safety glasses or goggles.
4. Keep the fingers clear of the clamping bar and blade.
5. Make sure no one but the operator is inside the safety zone and he/she is clear of counter balance.
6. Fold only a single thickness of sheet metal within the capacity of the brake.
7. Make certain the counterweight bars do not strike others, while working.
8. Get assistance when bending large, thick material in order to avoid back strain.
9. Hold the handle firmly.
10. Make sure the area in front of the brake is clear before swinging the folding apron up.
11. Let the bar down slowly after completing a bend.

12. Handle carefully the sheet metal that is being formed in order to avoid cuts.

13. Always stand clear of the folding apron balance weights.

14. Keep the floor area in front of the brake clear and clean to avoid slipping.

BOX AND PAN BRAKE



1 Blade segments
2 Blade position handle
3 Wing handle
4 Blade holding bolts
5 Height adjustment
6 Wing handle
7 Wing

BOX AND PAN BRAKE SAFETY QUIZ

NAME ______________________________

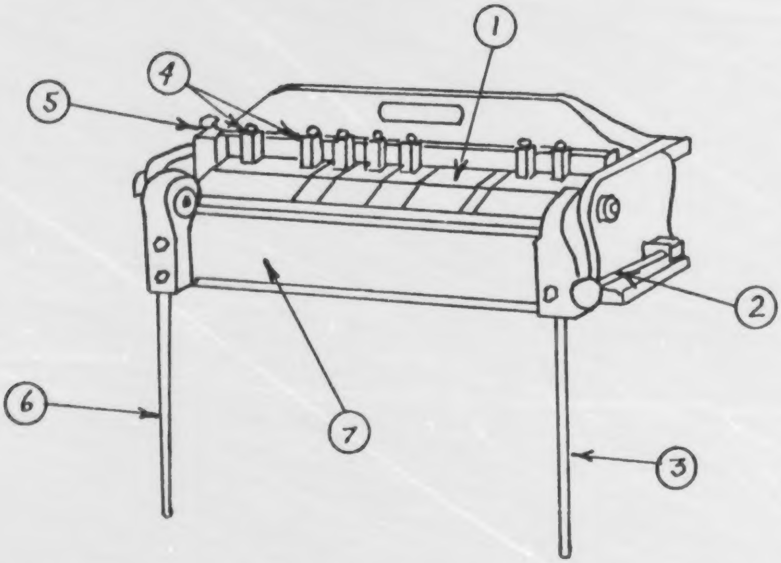
CLASS _____________________________

DATE _______________ GRADE ________

(Circle true or false)

1.	One should always release the bar quickly after completing a bend.	T	F
2.	Safety glasses must always be worn when using the brake.	T	F
3.	The handle should be held firmly.	T	F
4.	If necessary, more than one piece of metal can be folded at a time.	T	F
5.	A person should get assistance when bending large pieces of sheet metal.	T	F
6.	Sheet metal can cause severe cuts.	T	F
7.	The counter weights could strike the operator if he/she is not careful.	T	F
8.	When one has finished with the brake, he/she should throw the scrap metal in a neat pile on the floor.	T	F
9.	One does not have to ask the teacher's permission in order to use this simple machine.	T	F
10.	No one but the operator should be inside the safety zone.	T	F
11.	The clamping bar can pinch the fingers.	T	F

In the spaces provided, identify the parts of the box and pan brake:



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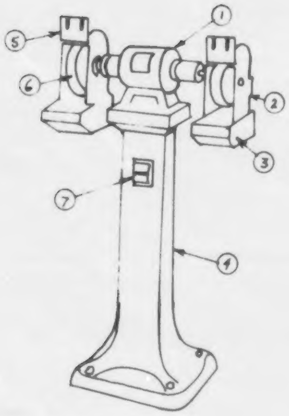
BUFFER



1. MOTOR
2. WHEEL GUARD
3. DUST CHUTE
4. PEDESTAL
5. SAFETY DEFLECTOR
6. BUFFING WHEEL
7. SWITCH

1. Buffers shall be provided with suitable hoods or enclosures that are connected to an exhaust system. (OSHA)

2. A pupil must obtain permission from the teacher before using the buffer.

3. Work must be held securely, using both hands.

4. The teacher should be asked for special instruction and permission to buff small pieces.

5. A face shield or safety glasses shall be worn.

6. Compound should be applied sparingly.

7. Hands must be kept away from the wheel while it is in motion.

8. Work should be held below the center (horizontal axis) as the wheel revolves toward the operator.

9. Flat surfaces must be buffed from the center toward the lower edge. Sharp edges should point downward.

10. Material should be pressed against the wheel with just enough pressure to cause the wheel to polish the material.

11. The power must be turned off after using the buffer.

12. The buffer and its area should be cleaned with a brush or an air gun.

13. One should always stand to one side of the wheel when applying compound.

14. Gloves, rags, or part of a shop coat must *never* be used to hold the work piece.

15. Caution should be exercised to avoid overheating and burns to the hands.

16. Jewelry should be removed, loose clothing eliminated, and long hair confined.

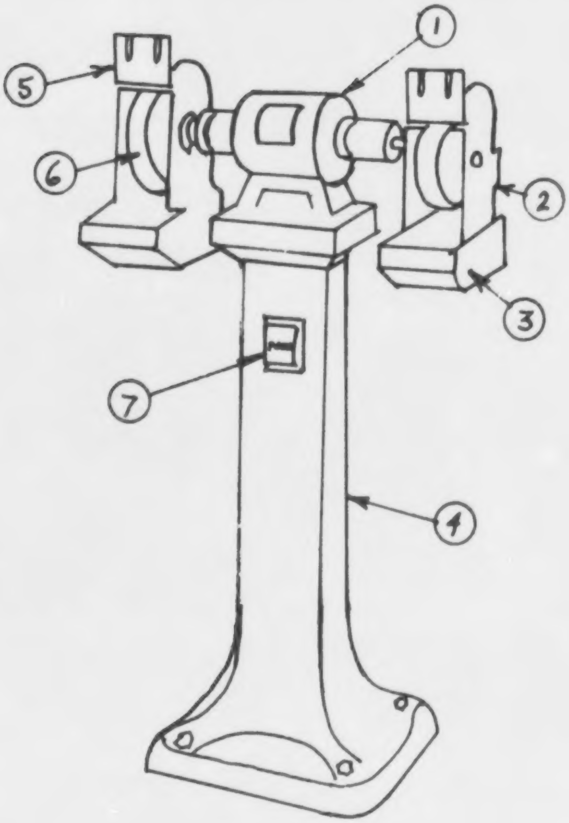
17. The operator should make sure all guards are in place and operating correctly.

18. It is important to use care when buffing around corners or openings where the wheel could grab or throw the work piece.

19. The area behind the buffer should always be open and no one but the operator should be in the safety zone.

20. One should never take one's eyes off the work even for an instant while using the buffer.

BUFFER



1 Motor	5 Safety deflector
2 Wheel guard	6 Buffing wheel
3 Dust chute	7 Switch
4 Pedestal	

BUFFER SAFETY QUIZ

NAME________________________________

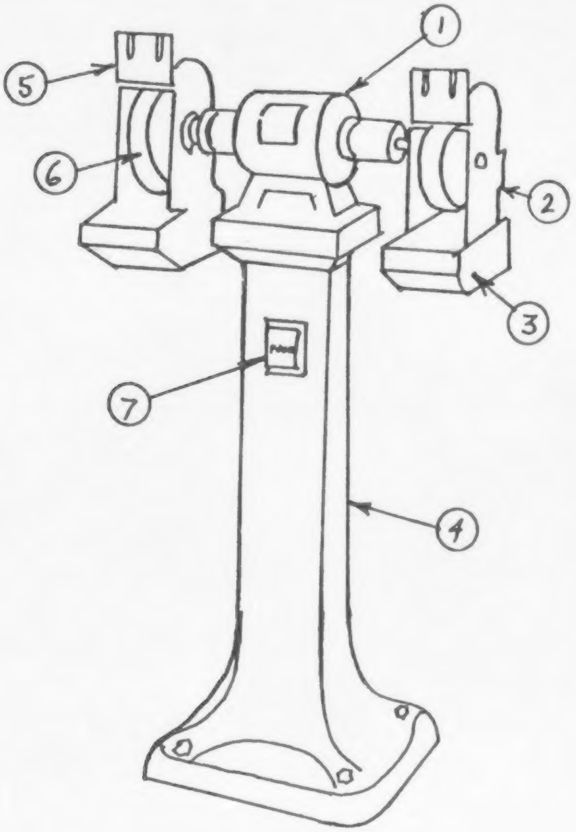
CLASS_______________________________

DATE__________________GRADE__________

(Circle true or false)

1. A rag should be used to hold hot objects while buffing. T F
2. One should always buff on the lower half of the wheel. T F
3. It is not necessary to wear eye protection if buffing compound is used. T F
4. Special permission to buff small pieces must be obtained from the teacher. T F
5. A person who is using the buffer should point the sharp edges of his/her work upwards. T F
6. A heavy coat of compound should be applied to the wheel. T F
7. A person should stand to one side when applying compound to the wheel. T F
8. One should keep one's eyes on the work at all times. T F
9. The operator should lightly touch the wheel with his/her hand to check for the proper amount of compound. T F
10. A person who is applying too much pressure when buffing around corners can cause the wheel to grab the work piece. T F
11. No more than two people should work on the buffer at a time. T F

In the spaces provided below, identify the parts of the buffer:



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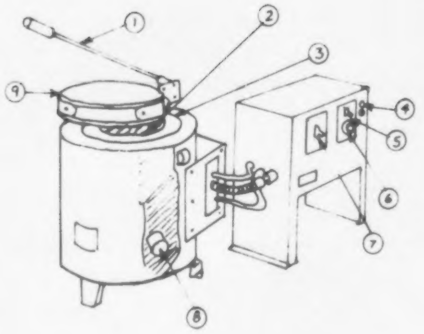
CRUCIBLE FURNACE



1. LID HANDLE
2. FIRE BOX WITH CRUCIBLE
3. FIRE BRICK
4. SWITCH
5. IGNITER SWITCH
6. AIR CONTROL
7. GAS CONTROL
8. CLAY DRAIN PLUG
9. LID

1. Whenever protective equipment is provided, it shall be the duty of each pupil to use this equipment. (OSHA)
2. Inhaling fumes from brass, zinc, galvanized iron, or lead paint must be avoided.
3. The furnace shall be operated only with the teacher's permission and after instruction has been received.
4. Jewelry should be removed, loose clothing eliminated, and long hair confined.
5. All guards must be in place and operating correctly.
6. Proper eye protection is required.
7. Protective clothing must be worn (coat, gloves, face shield, shoes, and leg protectors).
8. Metal must not be thrown or dropped into the crucible. Tongs should be used.
9. Metal shall never be melted or poured in an unventilated place. The fumes may be injurious.
10. Moisture must be kept out of the furnace and metal when one is working with hot metals.
11. Caution should be exercised in the foundry area. Crucibles, equipment, flasks, and castings may be hot.

12. Flammable materials (paints, solvents, etc.) must be kept away from the foundry area.

13. The mold is to be checked by the teacher before it is closed to make sure that it is not too damp or too dry.

14. Molds must remain covered until they are ready for pouring.

15. The pupil should practice lifting and pouring with a cold, empty crucible. He/she should run through the entire procedure several times.

16. The furnace should be lighted only when directed by the teacher. Instructions should be carefully followed.

17. The teacher should be asked to check the moisture content of any molding sand that has been tempered, before it is used for making a mold.

18. One should never pour a mold unless one is sure that the moisture content of the sand is correct. Too much moisture in the sand will cause an explosion.

19. Weights should be put on a flask before pouring hot metal. Unless it is weighted, the metal may run out on the floor.

20. A crucible of melted metal is never to be lifted or handled unless the tongs that are used will grip it firmly and evenly.

21. Metal should be poured slowly and kept close to the floor.

22. If the floor is concrete, someone should be standing by to shovel foundry sand on all spills. Concrete explodes violently when heated.

23. It is important to remember that prior to removing the crucible the worker should shut off the gas first, then the air. A crucible lifter should be used to remove crucible from the furnace.

24. Water and wet items must be kept away from the foundry area, except for tempering the sand.

25. In consumable pattern casting (styrofoam), the sprue basin should be kept filled to prevent firing. The foundry room area vent fan should be turned on. It is also important that persons working in the area not breathe the fumes.

26. Castings should be allowed to cool before breaking them out of the molds.

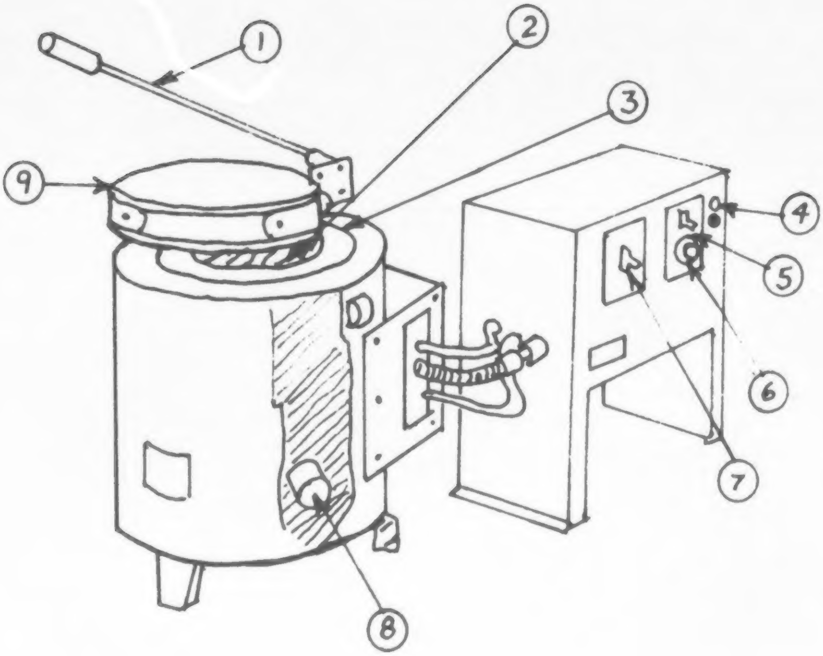
27. The crucible should be completely emptied. Solidified metal will crack the crucible when it is reheated.

28. Each worker should know where the fire extinguisher is located before attempting to pour hot metals.

29. No crucible furnace shall be operated unless approved safety devices (i.e., ultraviolet or thermo controls) are attached to control the flow of gas.

30. The furnace must be equipped with spark lighters--do not light by throwing in lighted papers.

CRUCIBLE FURNACE



1 Lid handle	6 Air control
2 Fire box with crucible	7 Gas control
3 Fire brick	8 Clay drain plug
4 Switch	9 Lid
5 Igniter switch	

CRUCIBLE FURNACE SAFETY QUIZ

NAME ______________________________

CLASS ____________________________

DATE _______________ GRADE ______

(Circle true or false)

1. Metal accidentally spilled on the floor should be kicked aside. T F
2. Hot metal should be poured as quickly as possible. T F
3. Protective clothing is necessary only when charging the crucible. T F
4. Metal should not be thrown or dropped into the crucible. Tongs should always be used. T F
5. If goggles are used, a face shield is not necessary. T F
6. If water comes in contact with the molten metal, it will cause an offensive odor. T F
7. The pupil must always get the teacher's permission before lighting the furnace. T F
8. When one has finished using the furnace, one should shut off the air first. T F
9. Fumes from brass are not harmful. T F
10. Long hair is not as dangerous in the foundry area as in other areas of the metal lab. T F
11. Moisture may cause explosions in the foundry area. T F
12. Some molten metal should be left in the crucible after pouring. T F
13. The tongs should fit loosely around the crucible. T F

(Circle true or false)

14. One should practice lifting the cold crucible from the furnace before the actual melting is done. T F

15. Leg protectors are an important safety precaution. T F

16. The fumes from styrofoam are not harmful. T F

17. Styrofoam patterns may cause flames to shoot from the sprue hole if the basin is not kept filled. T F

18. Molds should be broken out of the sand immediately after pouring. T F

19. It is not always necessary for a teacher to check every mold before pouring. T F

20. The crucible should be held approximately 24 inches above the floor when pouring is done. T F

21. Weights are placed on the mold before pouring to ensure a good seal between the flask halves. T F

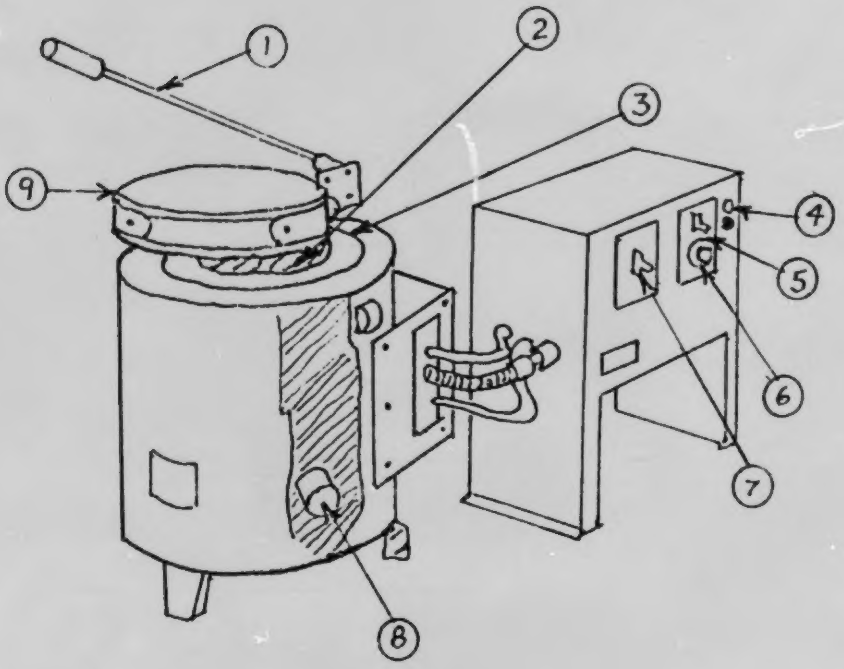
22. The moisture content of the sand should be checked by the teacher. T F

23. Water can be used for tempering sand. T F

24. It is the pupil's duty, as well as his/her responsibility, to wear and use all safety equipment that is provided. T F

25. Solvent should be kept near the foundry area so it can be used to clean the floor in case of a spill. T F

In the space provided, identify the parts of the crucible furnace:



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Signed: ____________________
Pupil

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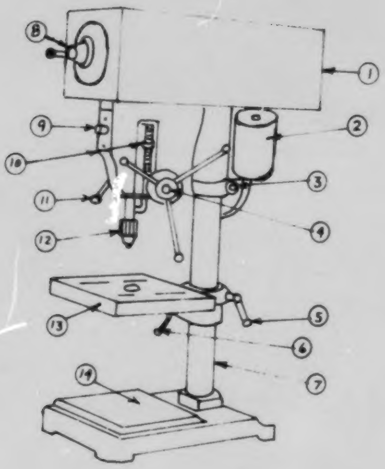
Date: ____________________

DRILL PRESS



1. BELT GUARD
2. MOTOR
3. HEAD SUPPORT COLLAR
4. PILOT WHEEL FEED
5. TABLE LOCKING CLAMP
6. TILT ANGLE LOCKING CLAMP
7. COLUMN
8. VARIABLE SPEED CONTROL
9. SWITCH
10. DEPTH STOP
11. QUILL LOCK
12. QUILL
13. TILTING TABLE
14. BASE

1. The V-belt drive of all drill presses, including the usual front and rear pulleys, shall be guarded to protect the operator from contact or breakage. (OSHA)

2. Eye protection must be worn.

3. The operator must work alone at the machine--starting and stopping it himself/herself.

4. Sleeves should be rolled up.

5. Rings, bracelet, and wristwatch must be removed.

6. The metal stock must be held securely, either in a heavy drill vise (which may be clamped to the drill press table) or with the work clamped directly to the drill press table. The wood stock should be held with a clamp if it cannot be held by hand.

7. The operator should feed only fast enough for the drill to cut well.

8. Pressure should be released occasionally to break the shavings, when drilling in metal.

9. Shavings must not be removed while the machine is running.

10. Cutting oil should be applied on material requiring it.

11. Pressure should be released when the drill goes through the material.

12. A brush must be used to remove chips or shavings.

13. The operator should check to make certain that the bit is properly sharpened and securely fastened in the drill chuck before starting the machine.

14. The belt should be adjusted to the proper pulley combinations for the required speed. The belt guard must be in place before any operation of the machine.

15. The hole must be placed in the center of the table, directly under the drill if possible, to prevent the drill from striking the table.

16. The depth stop should be set to the required depth if the hole is not being drilled through the stock.

17. The drill should be withdrawn frequently when drilling deep holes in order to prevent "burning" and "freezing" of the drill in the stock.

18. All adjustments must be made while the machine is stopped.

19. The operator should check to make certain that the key, drifts, and wrenches are all removed before starting the machine.

20. Centers for the holes in the metal are located by centering the punching.

21. Gloves should never be worn while operating the drill press.

22. The operator should not drill into a container that may have contained flammable materials or liquids.

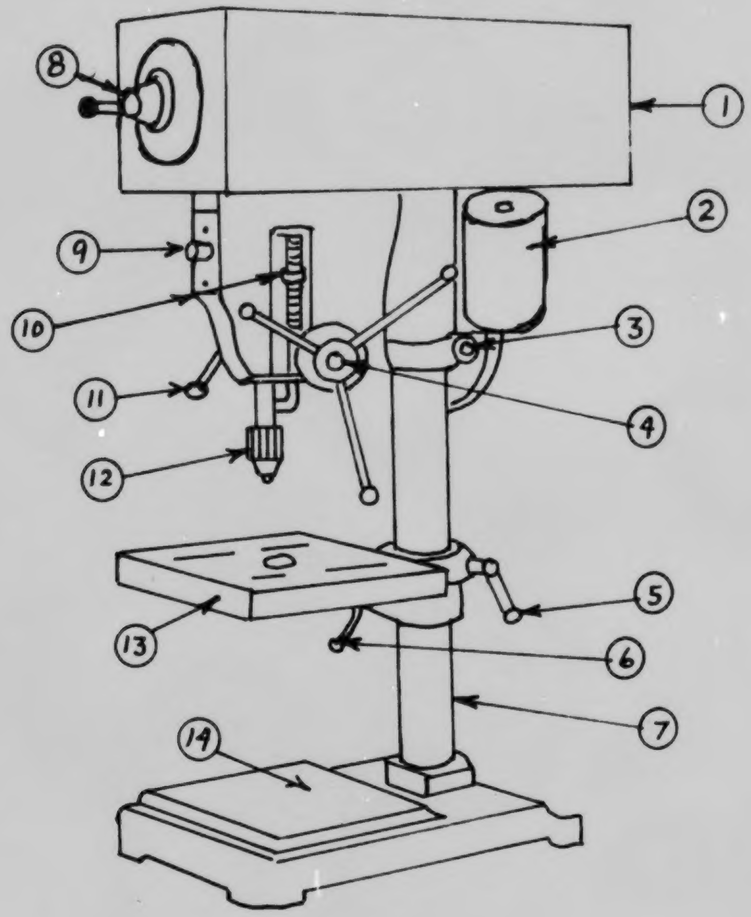
23. The round stock should be held in a "V" block.

24. Loose-fitting clothes should never be worn.

25. The operator should turn off the power after using the drill press and stand by until the machine has stopped.

26. The drill press table and surrounding area must be cleaned. Cleaned drills, coolants, and clamping devices should be returned to their designated places.

DRILL PRESS



1	Belt guard	8	Variable speed control
2	Motor	9	Switch
3	Head support collar	10	Depth stop
4	Pilot wheel feed	11	Quill lock
5	Table locking clamp	12	Quill
6	Tilt angle locking clamp	13	Tilting table
7	Column	14	Base

Drill Press Safety Quiz

Name ______________________

Class ______________________

Date ____________ Grade ________

(Circle true or false)

1. When using the drill press, clamp small work in a vise or clamp it to the drill press table. T F
2. When drilling, remove the shavings from the work with a brush, not with the hand. T F
3. Increase the pressure on the drill slightly, just as it starts to break through a piece of steel, in order to cut a clean hole. T F
4. Keep a light film of oil on the floor around the drill press so that chips will not stick to it. T F
5. Be sure the switch is off when making adjustments on the drill press. T F
6. Do not wear loose, floppy clothing when operating a drill press. T F
7. Leave the chuck key in the chuck after using a drill press so it won't get lost. T F
8. Keep the cover or guard over the V-belt drive of the drill press. T F
9. Use a brush to remove chips. T F
10. Use dull drill bits to cut through soft material. T F
11. Wear gloves to protect hands from burns. T F
12. Wear rings while operating a drill press. T F
13. Operate the drill at top speed for all work. T F

(Circle true or false)

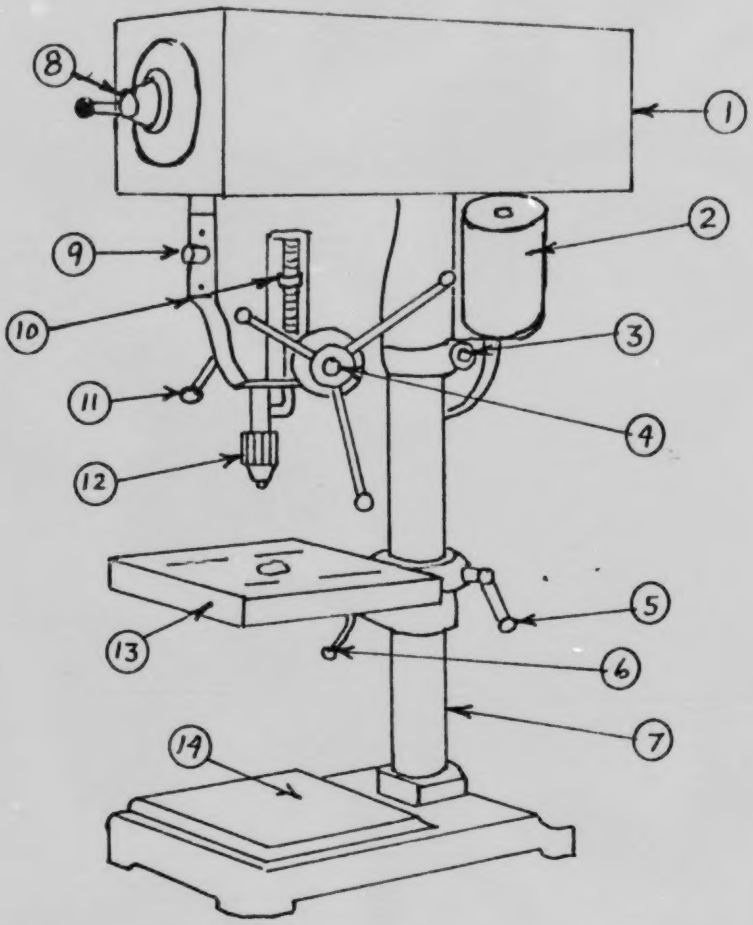
14. Drill into a container that may have contained combustible or flammable liquids or materials. It is perfectly safe. T F

15. Talk to someone while operating the drill press. It makes the work go faster. T F

16. Force the drill through the work as fast as it will go. T F

17. Wait for the drill press to come to a complete stop before leaving the machine. T F

In the space provided, identify the parts of the drill press: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Signed: ____________________
Pupil

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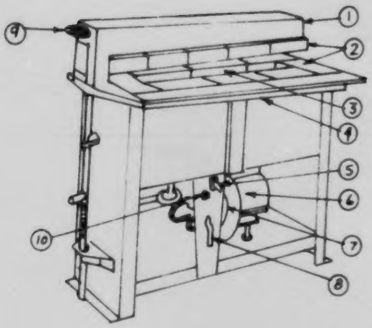
Teacher

Date: ____________________

GAS FORGE



1. LID
2. FIRE BRICK
3. FIRE BOX
4. WORK RACK
5. AIR CONTROL
6. BLOWER MOTOR
7. BLOWER
8. GAS CONTROL
9. LID HANDLE
10. IGNITER SWITCH

1. Obtain permission from the teacher before lighting the gas forge.
2. Clear the area of all flammable material.
3. Keep the area well-ventilated.
4. Wear a face shield, safety glasses, or goggles.
5. Make sure no one but the operator is in the operator's zone.
6. Keep the lid of the forge open when lighting it.
7. Follow the manufacturer's sequence of directions for igniting air and gas.
8. Always put hot articles where they will not be accidentally touched, causing burns.
9. Always keep the floor clean to avoid stumbling and falling.
10. Wear asbestos gloves when tongs are not used.
11. Use chalk to label hot metal that is left unattended. It must be marked "HOT."
12. Follow safety instructions when moving hot metal. Warn all persons who may be in the way. Consider all the metal around the furnace as being hot.
13. Keep the anvil face clear of scraps and flakes of metal.

14. Hammer only the metal being forged. Strike the hammer on the face of the anvil.

15. Stand so that the face is protected when quenching metal.

16. Never attempt to forge flammable metals.

17. Use the proper tongs to handle hot metal.

18. Use only tools with safe handles and properly dressed heads.

19. Shut off the gas first and then the air when work with the forge is finished.

20. Quench the hot tongs before putting them away.

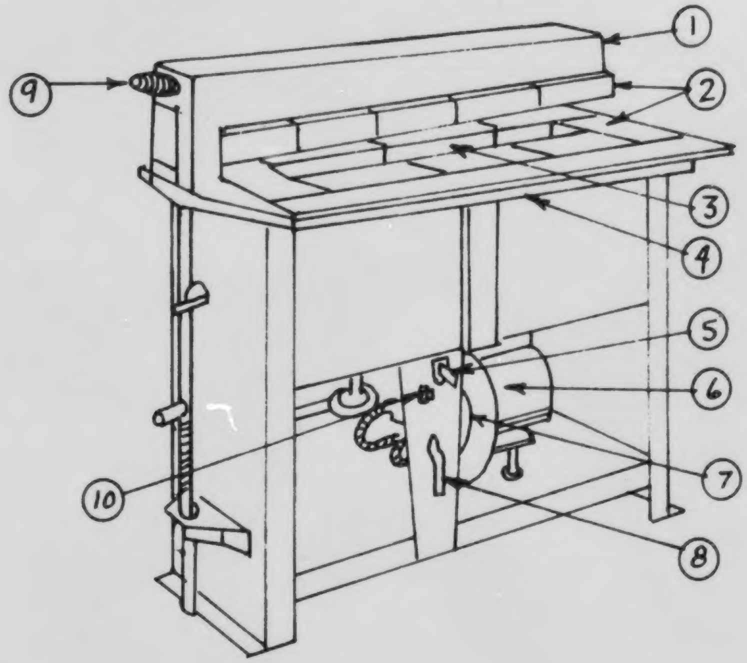
21. Know where the fire extinguishers are located in the lab prior to starting the forge.

22. Always keep a pail of water near the forge.

23. No forge furnace shall be operated unless approved safety devices (i.e., ultraviolet or thermo controls) are attached to the flow of gas.

24. The furnace must be equipped with spark lighter--do not light by throwing in lighted paper.

GAS FORGE



1	LID	6	BLOWER MOTOR
2	FIRE BRICK	7	BLOWER
3	FIRE BOX	8	GAS CONTROL
4	WORK RACK	9	LID HANDLE
5	AIR CONTROL	10	IGNITER SWITCH

GAS FORGE SAFETY QUIZ

NAME________________________________

CLASS________________________________

DATE__________________GRADE______________

(Circle true or false)

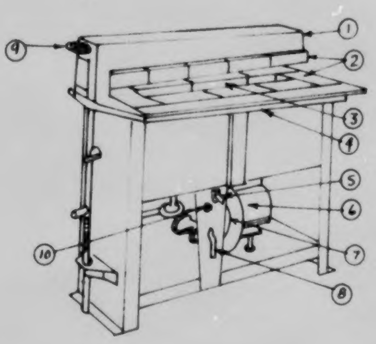
1. Tongs should be used to handle hot metal. T F
2. The lid should be closed when lighting the forge. T F
3. Hot metal should be marked "HOT" with crayon. T F
4. The air should be turned off first when shutting the forge down. T F
5. Safety glasses are not really necessary after the forge has been started. T F
6. The handles of the tongs should be cooled before replacing them in the tool rack. T F
7. The exhaust fan should be turned on before starting the forge. T F
8. Hot metal should be left lying on the floor. T F
9. Strike the anvil with a hammer before striking the metal being forged. T F
10. A pail of cool drinking water should be kept near the forging area. T F
11. It is considered a safe practice to light the forge with a match held in the hand. T F
12. It is important to obtain the teacher's permission before using the forge. T F
13. One should locate the fire extinguishers after starting the forge. T F

(Circle true or false)

14. A person should stand so that his/her head is not directly over the work piece when quenching hot metal. T F

15. There should always be a can of alcohol near the forge to be used in case of an accident (such as fire). T F

16. In the spaces provided, identify the parts of the gas forge·



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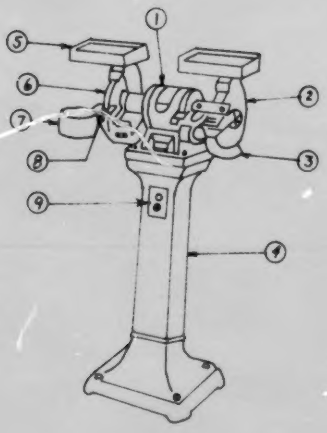
GRINDER



1. MOTOR
2. WHEEL GUARD
3. DUST DEFLECTOR
4. PEDESTAL
5. SAFETY SHIELD
6. ABRASIVE WHEEL
7. WATER POT
8. TOOL REST
9. SWITCH

1. Floor and bench-mounted grinders shall be provided with rests which are rigidly supported and readily adjustable. Such work rests shall be kept at a distance not to exceed 1/8 inch from the surface of the wheel. (OSHA)

2. The abrasive wheel guard shall cover the spindle end nut, and flange projections. (OSHA)

3. On bench and floor-stand grinding wheels, the safety guards shall be such that the exposure of the wheel will not exceed 90 degrees or one-fourth of the periphery. (OSHA)

4. On all grinders, the driving flange shall be securely fastened to the spindle. (OSHA)

5. Abrasive wheels shall be mounted between flanges which shall not be less than one-third the diameter of the wheel. (OSHA)

6. Any abrasive wheel shall be closely inspected before mounting and shall also be sounded by the user (with the ring test) to make sure it has not been damaged. (OSHA)

7. When bushings are used in the wheel hole on abrasive wheels, they shall not exceed the width of the wheel and shall not contact the flange. (OSHA)

8. Permission must be obtained from the teacher before using the grinder.

9. No one but the operator should be inside the operator's zone.

10. A face shield or safety glasses (goggles, spectacles) must be worn, and the glass safety guard on the grinder must be used.

11. An operator should stand to one side of the wheel when using the grinder.

12. Hands must be kept away from the wheel while it is in motion.

13. Work should be held with the hands. The teacher should be asked for special instruction and permission to grind small pieces.

14. Only the face of the wheel should be used.

15. Material should be pressed against the wheel with the correct amount of pressure.

16. The wheel must be dressed, when necessary.

17. Work should be kept in motion across the face of the wheel.

18. Power must be turned off after each use of the grinder.

19. Small pieces should be held securely in a proper holder. It is unsafe to hold small pieces in the hand, as they might get away and follow the wheel into the guard.

20. Adjustments must not be made with the grinder running.

21. Avoid grinding on the side of a light wheel. Side grinding must be done only on a wheel that is designed and built for this operation.

22. A wheel that will stand the maximum speed of the grinder must be used.

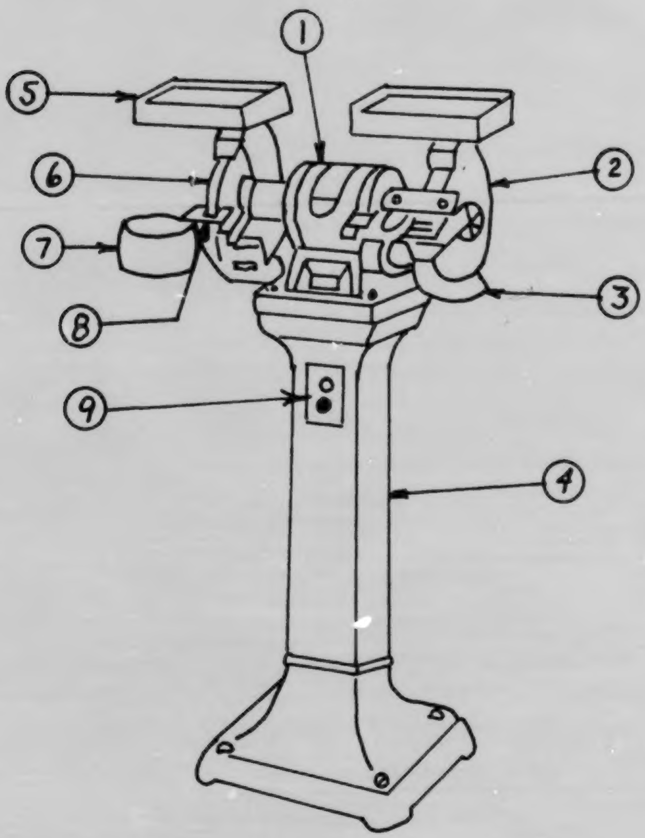
23. Stones should not be overheated. Cool the project in water. This protects tools, stone, and fingers.

24. Never grind any material except iron or steel on a grinder. Other materials stick to the wheel.

25. The operator should not stand directly in front of a grinding wheel when the grinder is started.

26. Work must not be jammed into the wheel.

GRINDER



1 Motor
2 Wheel guard
3 Dust deflector
4 Pedestal
5 Safety Shield
6 Abrasive wheel
7 Water pot
8 Tool rest
9 Switch

GRINDER SAFETY QUIZ

NAME ____________________________

CLASS ____________________________

DATE ______________ GRADE ______

(Circle true or false)

1. The grinder should be stopped before adjusting the tool rest. T F

2. Eye protection is not always necessary. T F

3. A grinding wheel that is suspected of being cracked should never be used. T F

4. It is unsafe to operate the grinder with the housing removed from around the grinding wheel. T F

5. A face guard is not necessary when the grinder has a glass shield. T F

6. The side of the wheel is used for rough grinding. T F

7. One should force material into the grinding wheel to remove the metal faster. T F

8. A wheel that vibrates excessively should not be used. T F

9. The paper should always be removed from the sides of the grinding wheel. T F

10. It is safe to operate the grinder when another person is standing nearby. T F

11. A grinding wheel may be used until it is worn to less than half its original diameter. T F

12. Pupils should leave the tool grinder without turning it off. T F

13. The grinder should not be used if it is poorly lighted. T F

(Circle true or false)

14. It is possible to determine if the stone is properly dressed by touching the face of the rotating wheel with the forefinger. T F

15. A piece of scrap metal can be forced into the wheel to stop it. T F

16. One should grind only iron and steel on the grinder. T F

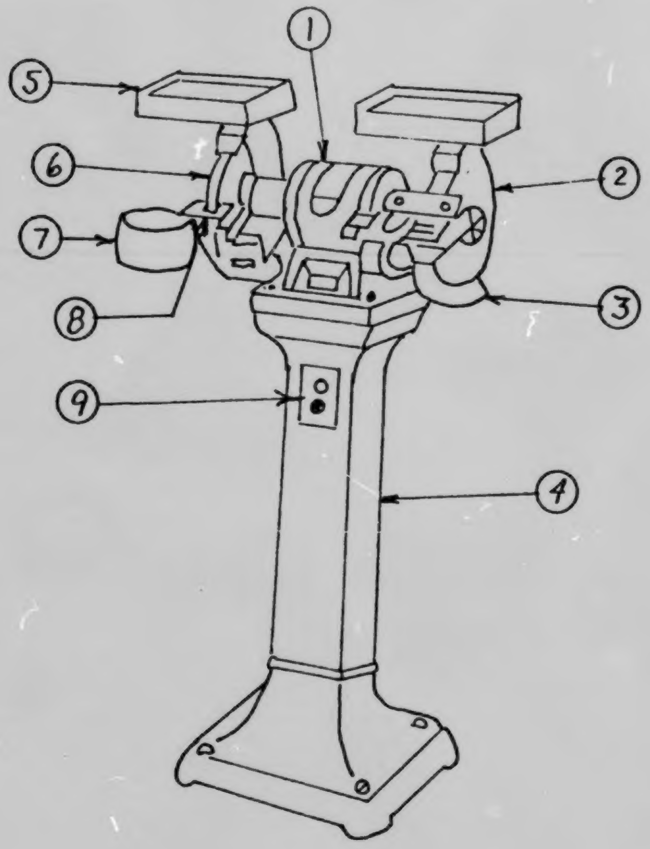
17. Small pieces of material that are to be ground can be held in the hand during grinding. T F

18. One should stand directly in front of the grinding wheel when the grinder is turned on. T F

19. The metal being ground should be cooled in oil. T F

20. Grinding should be concentrated on one particular portion of the wheel face. T F

In the spaces provided, identify the parts of the grinder:



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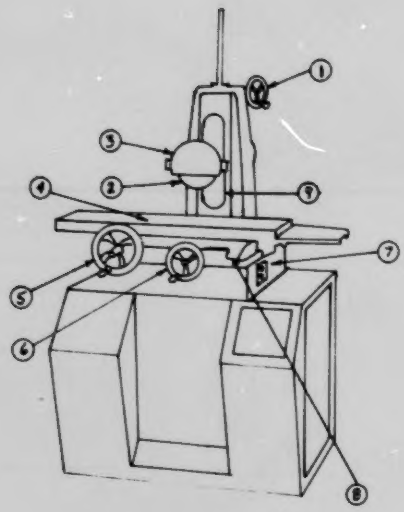
Date: ______________________

SURFACE GRINDER



1. VERTICAL FEED HANDWHEEL
2. GRINDING WHEEL
3. WHEEL GUARD
4. MAGNETIC CHUCK
5. HORIZONTAL FEED HANDWHEEL
6. CROSS FEED HANDWHEEL
7. OFF-ON SWITCH
8. SADDLE
9. DUST GUARD

1. On surface grinders, the exposed portion of the blade shall not exceed 150 degrees. (OSHA)

2. Safety guards are required to cover the SPINDLE END, NUT, AND FLANGE PROJECTIONS. (OSHA)

3. Labs performing dry grinding shall provide a suitable hood or enclosures that are connected to an exhaust system. (OSHA)

4. Eye protective devices shall be worn when grinding.

5. A person must be thoroughly familiar with all the electrical and mechanical equipment that is necessary for the operation of this machine.

6. The grinder shall not be used unless the wheel guard is in place and well secured.

7. If a magnetic chuck is used, one should make sure it is holding the work securely before starting.

8. The machine must be completely stopped before any adjustments are made or projects removed.

9. If the grinder wheel chatters, the grinder should be stopped. A stone may be loose on the spindle.

10. One should make sure the work clears the wheel before starting the machine. (Use a handwheel for the table movement.)

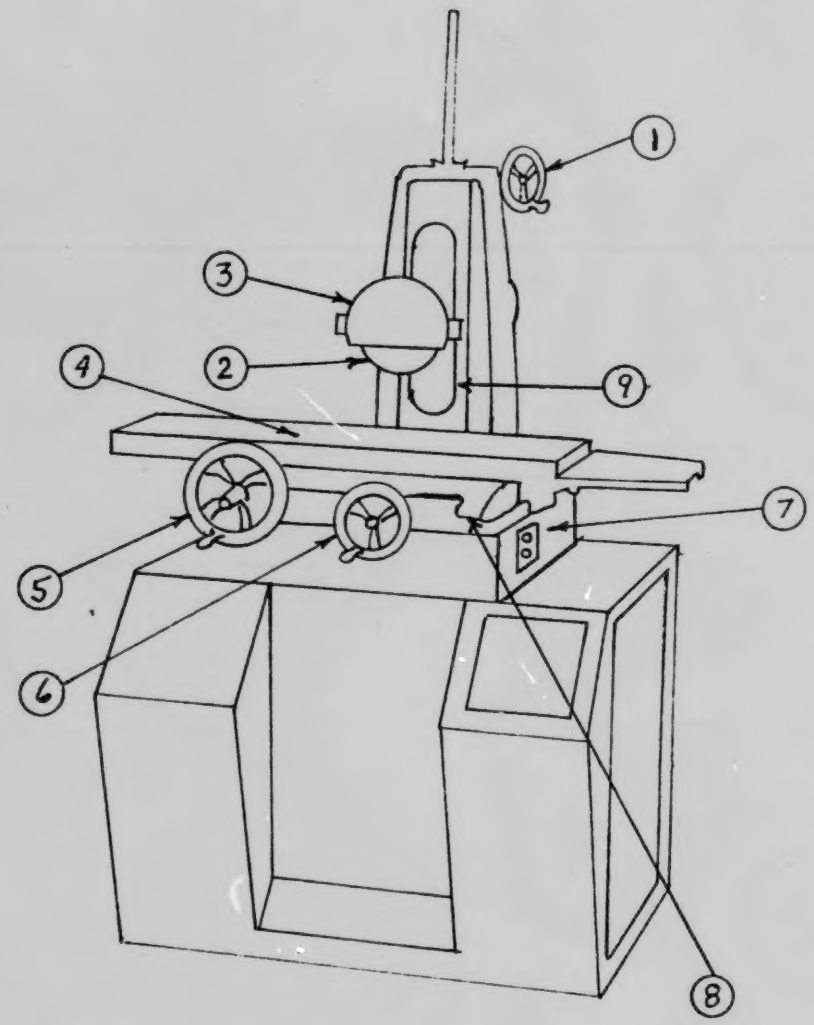
11. A grinding wheel should never be operated at speeds exceeding those recommended by the manufacturer.

12. Hands must be kept away from the moving parts while the automatic feed is engaged.

13. The work table shall be kept clear of tools, rags, etc.

14. A vise or clamp should always be used when grinding small or short pieces on a magnetic chuck.

SURFACE GRINDER



1 Vertical feed handwheel
2 Grinding wheel
3 Wheel guard
4 Magnetic chuck
5 Horizontal feed handwheel
6 Cross feed handwheel
7 Off-on switch
8 Saddle
9 Dust guard

SURFACE GRINDER SAFETY QUIZ

NAME________________________________

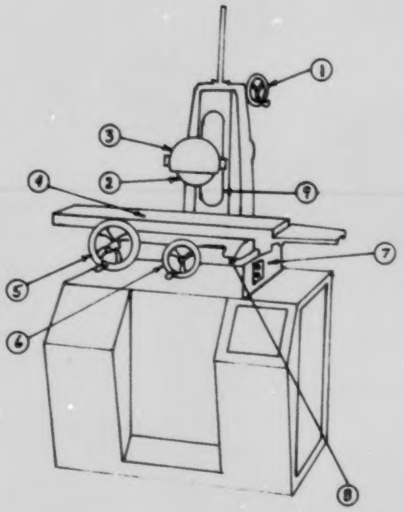
CLASS________________________________

DATE______________GRADE_______________

(Circle true or false)

1. Eye protection is not needed while the surface grinder is being set up for operation. T F
2. The power must always be turned off if a noise or vibration occurs. T F
3. It is not necessary to check the grinding wheel for cracks at the beginning of every new job. T F
4. Hands should be kept clear of the wheel while the grinder is running. T F
5. No more than two people should operate the surface grinder at any one time. T F
6. According to OSHA standards, the wheel of the surface grinder should not be exposed more than 180 degrees. T F
7. The surface grinder should not be operated unless the guard is positioned to cover the nut in the center of the wheel. T F
8. The work piece may be moved on a magnetic chuck while the machine is operating. T F
9. A rag or shop towel should always be kept on the table of the surface grinder. T F
10. Small or short pieces of metal may have to be held in a vise when using a magnetic chuck. T F

In the spaces provided, identify the parts of the surface grinder:



1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________
6. ______________________________
7. ______________________________
8. ______________________________
9. ______________________________

Signed ______________________________
Pupil

____
Teacher

____
Date

SAFETY GUIDE FOR GRINDING WHEEL USERS

Published By: Grinding Wheel Institute

The following rules are designed as a guide for the individual user of grinding wheels. Grinding is a safe operation when a few basic rules are followed. These rules are based on material contained in the American National Standards Institute Safety Code B7.1--"Use, Care and Protection of Abrasive Wheels." FOLLOW THEM.

GRINDING WHEELS ARE SAFE

DO

1. DO always HANDLE AND STORE wheels in a CAREFUL manner.
2. DO VISUALLY INSPECT all wheels before mounting for possible damage.
3. DO MAKE SURE OPERATING SPEED established for machine does not exceed wheel speed.
4. DO CHECK MOUNTING FLANGES for equal and correct diameter.
5. DO USE MOUNTING BLOTTERS when supplied with wheels.
6. DO be sure WORK REST is properly adjusted. (Center of wheel or above; no more than 1/8 inch away from wheel.)
7. DO always USE A SAFETY GUARD covering at least one-half of the grinding wheel.
8. DO allow NEWLY MOUNTED WHEELS to run at operating speed, with guard in place, for at least one minute before grinding.
9. DO always WEAR SAFETY GLASSES or some type of eye protection when grinding.
10. DO TURN OFF COOLANT before stopping wheel to avoid creating an out-of-balance condition.

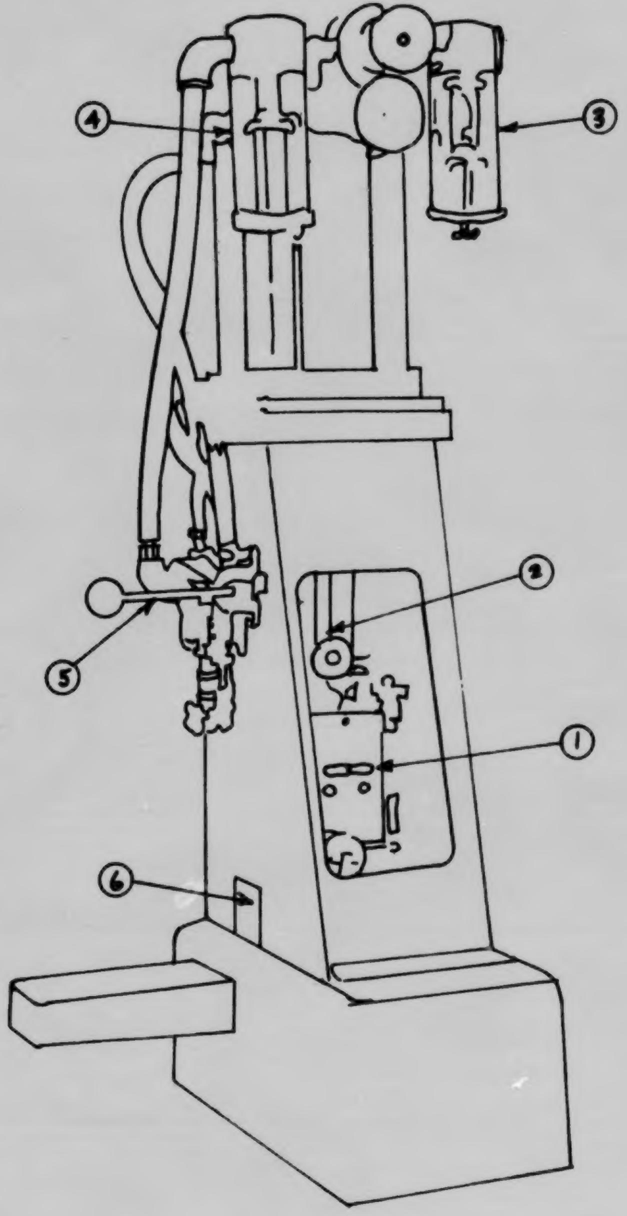
USE BUT DON'T ABUSE

DON'T

1. DON'T use a wheel that HAS BEEN DROPPED.
2. DON'T FORCE a wheel onto the machine OR ALTER the size of the mounting hole--if wheel won't fit the machine, get one that will.
3. DON'T ever EXCEED MAXIMUM OPERATING SPEED established for the wheel.
4. DON'T use mounting flanges on which the bearing surfaces ARE NOT CLEAN AND FLAT.
5. DON'T TIGHTEN the mounting nut EXCESSIVELY.
6. DON'T grind on the SIDE OF THE WHEEL (see Safety Code B7.1 for exception).
7. DON'T start the machine until the WHEEL GUARD IS IN PLACE.
8. DON'T JAM work into the wheel.
9. DON'T STAND DIRECTLY IN FRONT of a grinding wheel whenever a grinder is started.
10. DON'T grind material for which the WHEEL IS NOT DESIGNED.

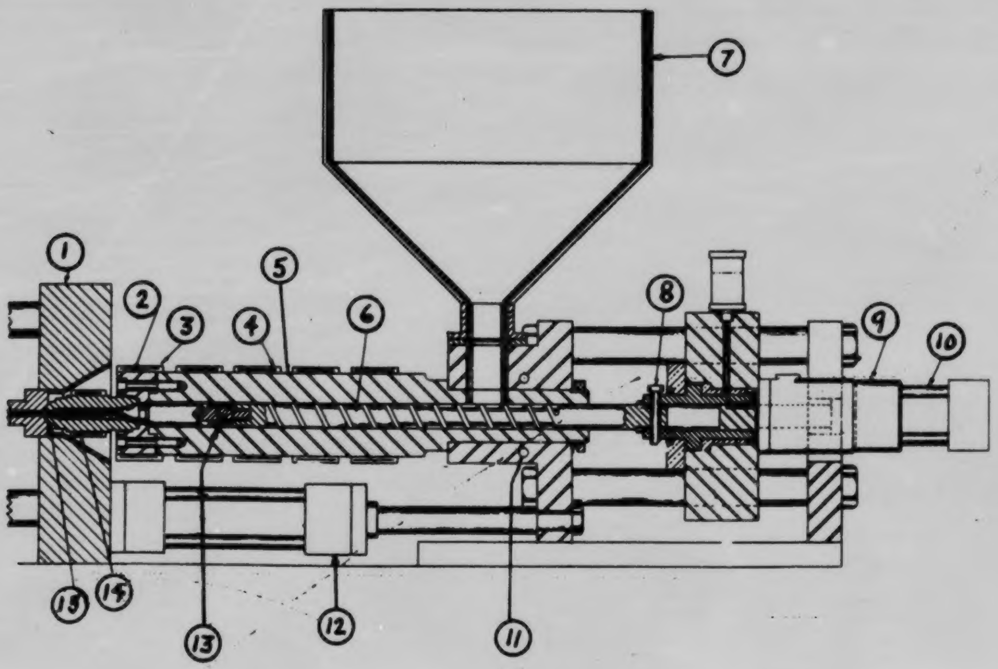
GRINDING
WHEEL
INSTITUTE

INJECTION MOLDER



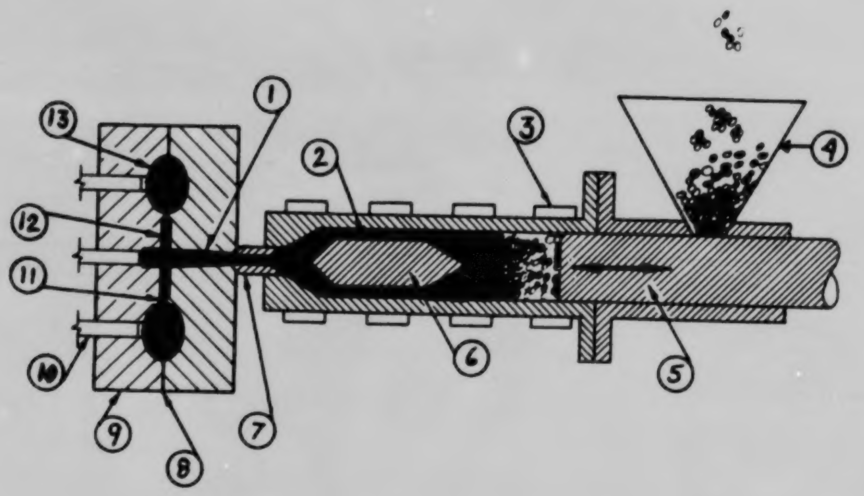
1 Heating chamber	3 Oil chamber	5 Ram operating handle
2 Ram	4 Air chamber	6 Mold vise

INJECTION MOLDER



1 STATIONARY PLATEN
2 NOZZLE ADAPTOR
3 HEATER
4 HEATER
5 BARREL
6 FEED SCREW
7 MATERIAL HOPPER
8 SHEAR PIN
9 HYDRAULIC MOTOR
10 INJECT CYLINDER
11 COOLING CHANNEL
12 CARRIAGE CYLINDER
13 NON-RETURN VALVE
14 NOZZLE HEATER
15 NOZZLE

INJECTION MOLDER



1 SPRUE
2 SUPPORT FINS
3 HEATERS
4 FEED HOPPER
5 INJECTION PISTON
6 TORPEDO
7 NOZZLE
8 VENT ALONG PARTING LINE
9 MOLD
10 EJECTION PINS
11 GATES
12 RUNNERS
13 CAVITY OR PART

INJECTION MOLDER SAFETY QUIZ

NAME ______________________________

CLASS _____________________________

DATE _______________ GRADE ______

(Circle true or false)

1.	Wear proper eye protection.	T	F
2.	Proper hand protection need not be worn.	T	F
3.	You must get permission from the teacher to use the machine.	T	F
4.	Damp floors around the machine are not a safety factor.	T	F
5.	All guards must be in place when using the machine.	T	F
6.	Parts of the machine are extremely hot.	T	F
7.	There is no danger to the fingers from pinching when using the injection molder.	T	F

Complete the following questions:

8. The heated plastic material is forced into the mold with _________ pressure.

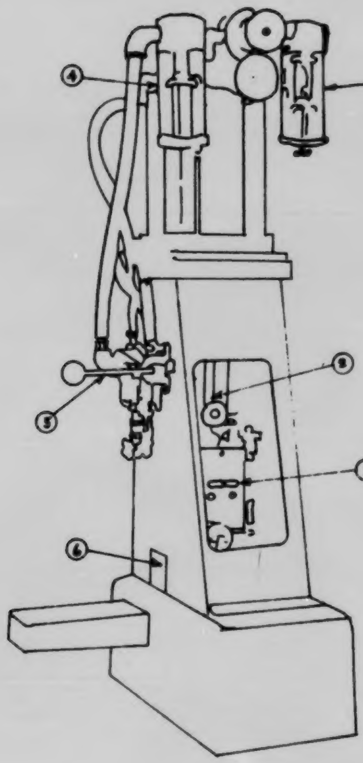
9. Control of the ___________ _________ and heat is necessary in order for plastics not to be forced from the molds.

10. Molded plastics remain very ____________ for a period of time after they are removed from the mold.

11. Caution bystanders when _______________ the machine.

12. _______________ operated machines are quicker in movement than hydraulic machines.

13. In the spaces provided, identify the parts of the injection molder.



1. ______________________________

2. ______________________________

3. ______________________________

4. ______________________________

5. ______________________________

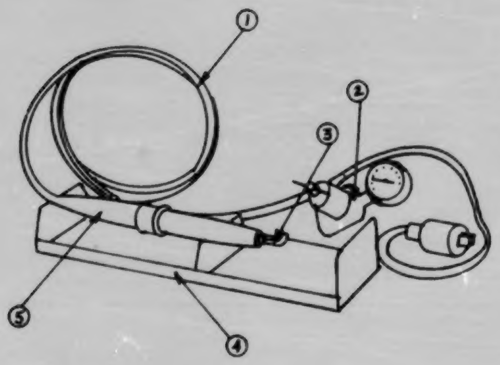
6. ______________________________

Signed ______________________________
Pupil

____
Teacher

Date ______________________________

PLASTICS WELDER



1. AIR HOSE & 115 VOLT CABLE
2. AIR REGULATOR & GAUGE
3. TIP
4. WELDER STAND
5. AIR COOLED HANDLE

1. Wear eye protective devices.

2. Use caution when working with the hand held unit because it gets very hot, and the operator could be burned.

3. Do not direct hot air onto the skin.

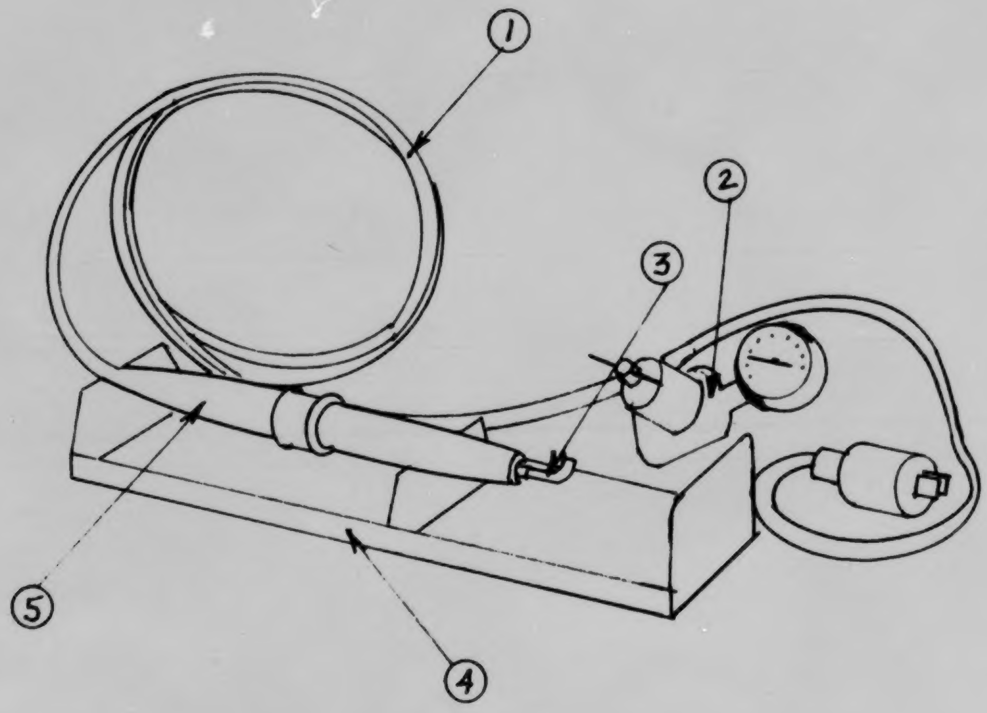
4. Use the proper ventilation to reduce fumes.

5. Obtain permission from the teacher before using the plastics welder.

6. Wear heat resistive gloves when handling the work pieces which will remain hot for a period of time.

7. Beware of the electricals in case of damp conditions. Do not use in areas where grounding is possible.

PLASTICS WELDER



1 AIR HOSE & 115 VOLT CABLE

2 AIR REGULATOR & GAUGE

3 TIP

4 WELDER STAND

5 AIR COOLED HANDLE

PLASTICS WELDER SAFETY QUIZ

NAME________________________________

CLASS________________________________

DATE______________GRADE______________

(Circle true of false)

1. Some fumes from heated plastics can be harmful. T F

2. The welded parts will cool very quickly. T F

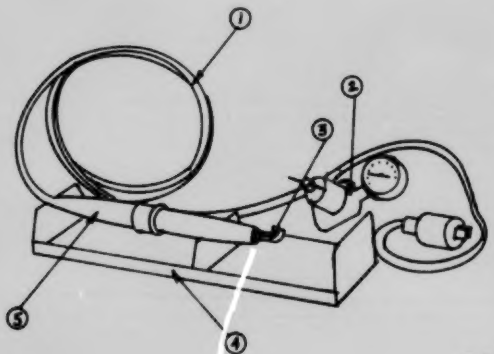
3. Being a hand held electrical tool the dangers of shock are increased when the operator has wet hands. T F

Complete the following questions.

4. The welder works by applied____________ ____________onto the surface of the work pieces.

5. Name two types of personal protective devices that should be used with the welder. (1)__________________________(2)__________________.

6. Name the parts of the machine.



1.____________________________

2.____________________________

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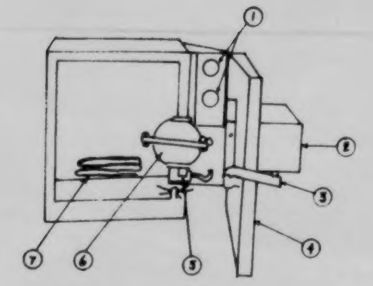
Signed______________________________
Pupil

____
Teacher

DATE______________________________

ROTATIONAL MOLDER



1. TEMPERATURE & TIME CONTROLS
2. VIEWING WINDOW
3. DOOR LATCH
4. DOOR
5. ROTATING MECHANISM
6. MOLD
7. HEATING ELEMENT

1. Wear eye protective devices.

2. Use heat resistive gloves to handle all molds. Parts of the machine and molds are extremely hot and may cause burns.

3. Cool molds properly before opening them.

4. Beware of moving parts of the rotational molder.

5. Control heat very carefully so the molder can be operated safely.

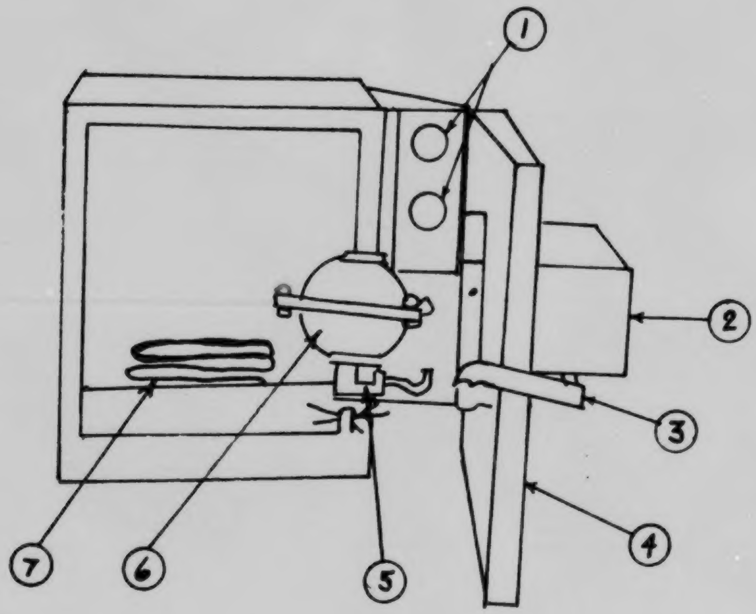
6. Make sure that molds do not leak. When molding with vinyl dispersion, leaks can cause a fire in the machine.

7. Ask the teacher for permission to operate the rotational molding machine.

8. Beware of the electricals in case of damp conditions.

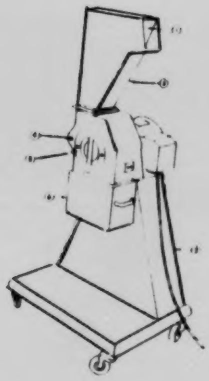
9. Clean up all spilled materials to prevent falls and injuries.

ROTATIONAL MOLDER



1	Temperature & time controls	4	Door
2	Viewing window	5	Rotating mechanism
3	Door latch	6	Mold
		7	Heating element

SCRAP GRINDER



1. SAFETY CURTAIN
2. FEED HOPPER
3. BASE
4. HINGE PIN
5. ROTOR COVER
6. COLLECTION DRAWER

1. Wear eye protection when using the machine.

2. Check plastic material for waste fragments of metal or wood before placing the material in the grinder.

3. Turn off the main switch of the machine before placing plastic scrap through the safety curtain into the feed hopper.

4. Keep hands clear of the feed hopper when the machine is on. Never place hands into the feed hopper even if the machine is turned off.

5. Never stand in front of, or open, the safety curtain when the machine is turned on.

6. Ask the teacher to verify if the direction of the motor is correct before operating the machine. (See included machine drawing for direction.)

7. Use ear plugs; noise may be excessive if machine is used for long periods. (Refer to Section X-Personal Protective Equipment.)

ROTATIONAL MOLDER SAFETY QUIZ

NAME______________________________

CLASS______________________________

DATE______________GRADE__________

(Circle true or false)

1. Rotational molding processes can be dangerous because of the moving parts involved in the machine. T F

2. The molds are cooled inside the machine so there is very little danger in handling the molds. T F

3. The molds must be heated carefully. T F

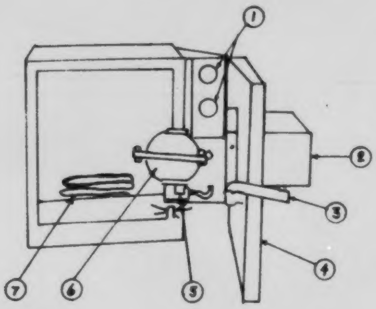
Complete the following statements:

4. Molds must be leak proof when using______________dispersions.

5. Material spills create a __________________hazard.

6. Always protect your eyes with_____________and your hands with _____________________.

7. Name the parts of this machine.



1.________________________

2.________________________

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6.________________________

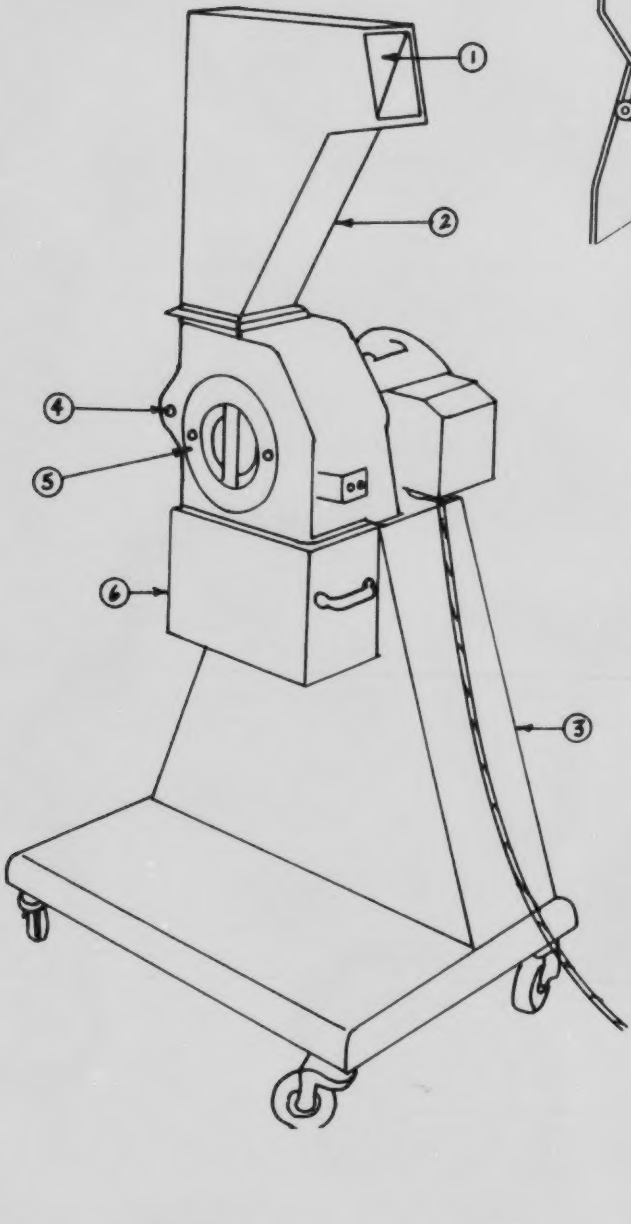
7.________________________

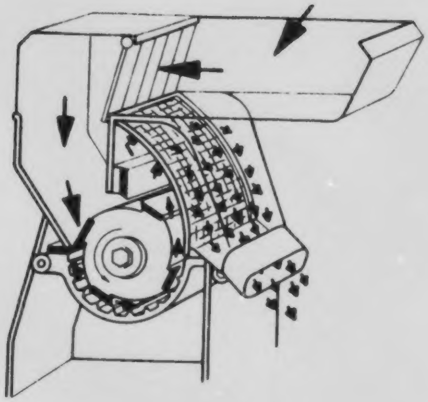
Signed________________________
Pupil

Date______________________________

____
Teacher

SCRAP GRINDER





Motor Direction

1 Safety curtain
2 Feed hopper
3 Base
4 Hinge pin
5 Rotor cover
6 Collection drawer

SCRAP GRINDER SAFETY QUIZ

NAME____________________________

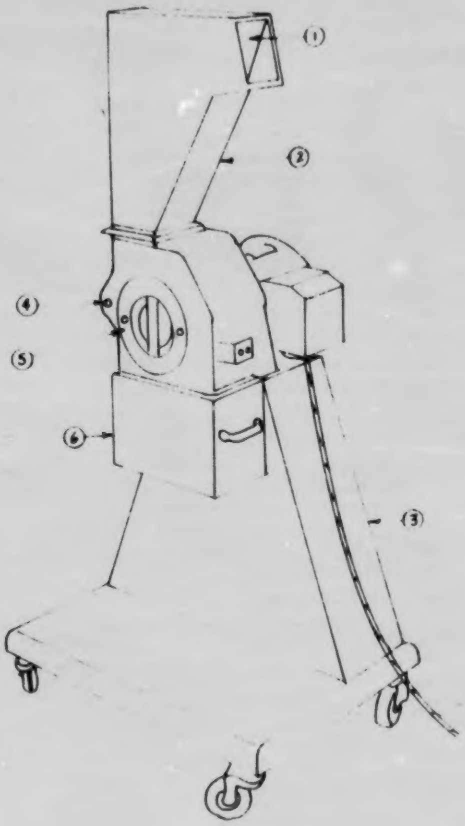
CLASS___________________________

DATE__________GRADE___________

	(Circle true or false)	
1. There is no need to wear safety glasses or goggles while using this machine.	T	F
2. Scrap material may be ground without checking for impurities.	T	F
3. When loading the feed hopper, you must be sure the main switch to the machine is turned off.	T	F
4. You may use your hands to clear the feed hopper.	T	F
5. Always stand to side of the machine and not in front of the safety curtain when the machine is on.	T	F
6. Noise is not a health factor when using this machine.	T	F

Scrap Grinder Safety Quiz(continued)

7. Name the parts of the machine.



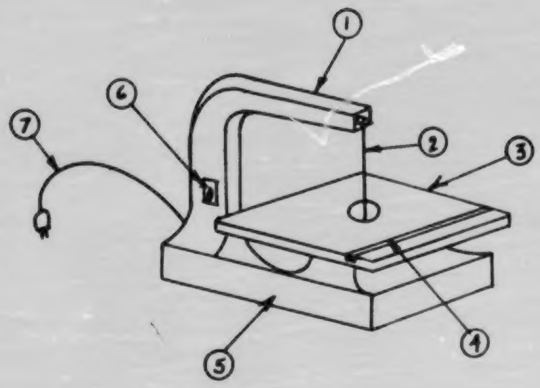
1. ____________________
2. ____________________
3. ____________________
4. ____________________
5. ____________________
6. ____________________

Signed ____________________
Pupil

____
Teacher

Date ____________________

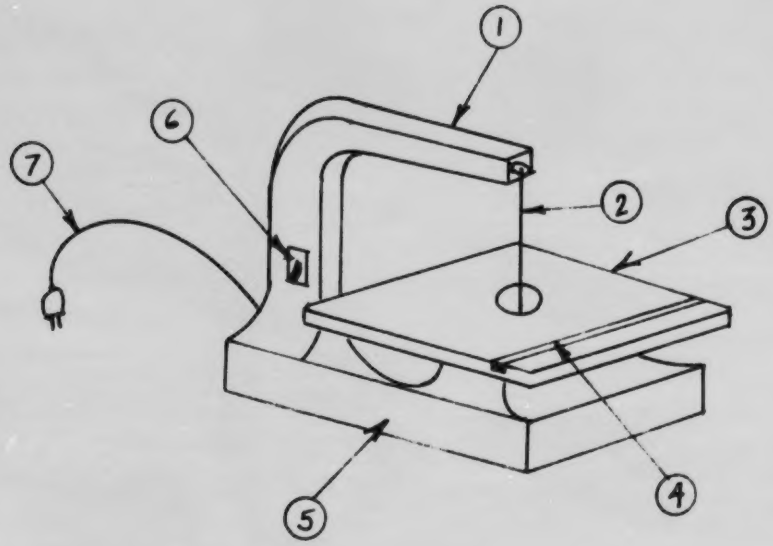
STYROFOAM CUTTER



1. OVER ARM
2. HEATED WIRE
3. TABLE
4. MITER GAUGE GROOVE
5. BASE
6. SWITCH
7. PLUG

1. Do not use the cutter near any ground; e.g., a water pipe or sink.
2. Use approved eye protection.
3. Avoid touching the nichrome wire, it is extremely hot.
4. Do not use the machine while standing on a wet floor.
5. Cut plastic material in an approved ventilated area.
6. Unplug the cutter when changing the nichrome wire.

STYROFOAM CUTTER



1	Over arm	5	Base
2	Heated wire	6	Switch
3	Table	7	Plug
4	Miter gauge groove		

STYROFOAM CUTTER SAFETY QUIZ

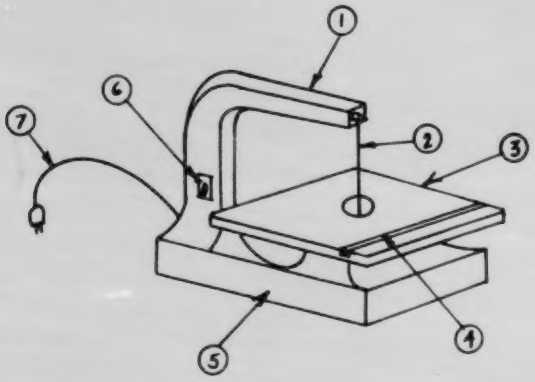
NAME ______________________________

CLASS ______________________________

DATE ______________ GRADE _____

(Circle true or false)

1. The cutter is not to be used where there is danger of grounding. T F
2. There is little danger of being burned when using the machine. T F
3. Eye protection is not necessary. T F
4. In the space provided, identify the parts of the styrofoam cutter.



1 ______________________________

2 ______________________________

3 ______________________________

4 ______________________________

5 ______________________________

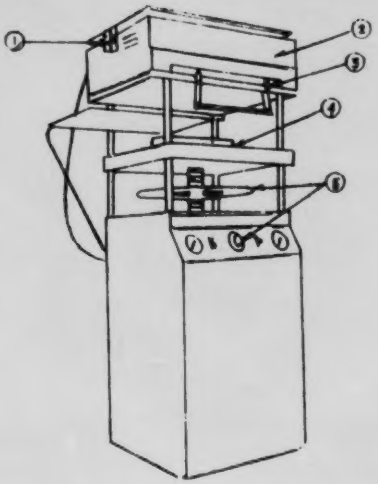
6 ______________________________

7 ______________________________

______________________________ Signed ______________________________
Date Pupil

____
Teacher

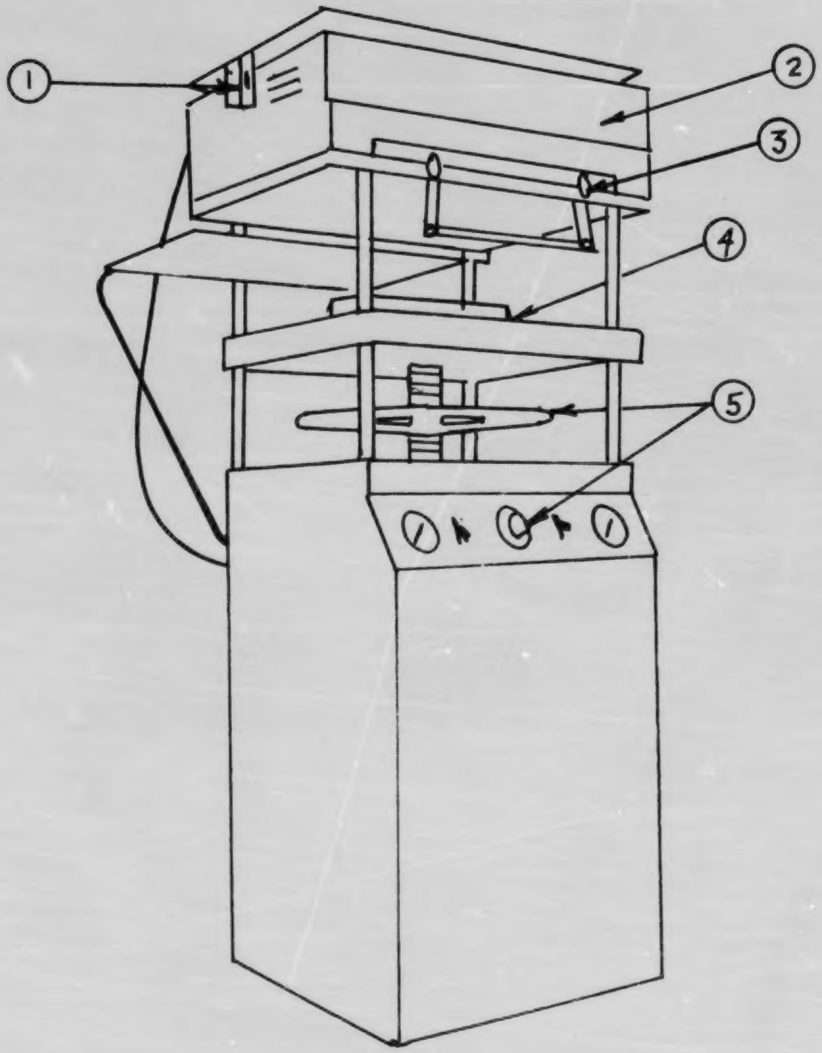
VACUUMFORMER



1. HEATER SWITCH
2. HEATER
3. CLAMPING DEVICE
4. MOLD SUPPORT
5. CONTROLS TO FORM PLASTIC

1. Wear eye protective devices.
2. Be sure that the clamp frame is adjusted to the thickness of the plastics.
3. Keep the hands away from the heating units. Serious burns may result if not observed.
4. Control the air pressure and vacuum in a manner that will not cause any hazards.
5. Do not touch the heated plastics until they have cooled properly. Use heat resistive gloves to unload parts.
6. Use a safety air nozzle gun to cool plastics, taking care to direct the air only on the plastics. Nozzle must be reduced to less than 30 PSI.
7. Remember that after forming the clamp frames will be very hot.
8. Don't leave the machine unattended in the heating cycle because the sheet stock could become overheated and start a fire.
9. Do not allow the sheet stock to come into contact with the heating element.
10. All safety guards must be in place and functioning.
11. Temperature and air pressure must be correctly adjusted.
12. Do not operate the machine if the floor is damp or if the machine is near a ground.
13. Always work with plastic material in a well-ventilated area.

VACUUMFORMER



1 Heater switch

2 Heater

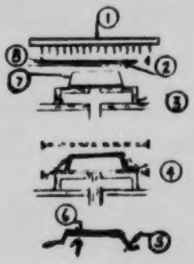
3 Clamping device

4 Mold support

5 Controls to form plastic

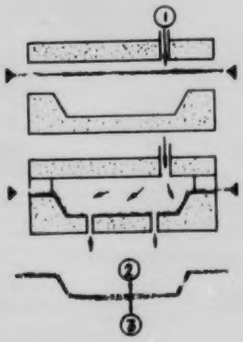
THERMOFORMING PROCESSES

There are basically three methods of thermoforming: vacuum forming, pressure forming, and mechanical forming. Machines used with these processes have similar safety rules.



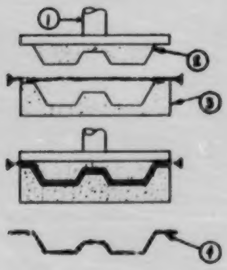
1. HEATER
2. PLASTIC SHEET
3. SEAL
4. VAC. SEAL
5. THIN AREAS-FORMED PART
6. THICKEST AREAS
7. MOLD
8. CLAMP

VACUUM FORMING is drawing material into the mold with the aid of vacuum.



1. PRESSURE FORMING AIR
2. THICK AREAS
3. FORMED PART

PRESSURE FORMING is forcing material into a mold with the aid of pressure.



1. RAM
2. MALE MOLD
3. FEMALE
4. FORMED PART

MECHANICAL FORMING is forcing material between a male and female mold.

VACUUMFORMER SAFETY QUIZ

NAME______________________________

CLASS______________________________

DATE____________GRADE____________

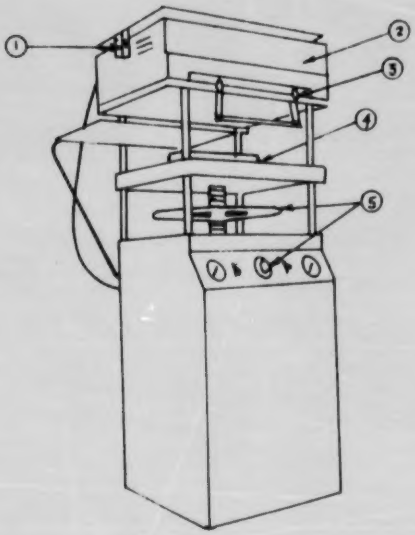
(Circle true or false)

1. The plastics materials used in sheet form could catch fire during the forming process. T F
2. The frames become very hot during forming operations. T F
3. Plastics materials are hot when they are lifted from the mold. T F
4. Wear eye protective devices. T F
5. Ventilation is not a prime concern when working with plastic materials. T F

Complete the following questions.

6. Temperature and ________________pressure must be correctly set.
7. The machine must not be operated when the floors are______________.
8. If the machine is in a heating cycle, do not______________________.

9. Name the parts of the machine.



1. ______________________________

2. ______________________________

3. ______________________________

4. ______________________________

5. ______________________________

Signed ______________________________
Pupil

____
Teacher

Date ______________________________

REFERENCES

Materials were selected and reviewed from the following sources, and in some instances were incorporated in the production of the preceding unit.

C. W. Brabender, Instruments, Inc.

Dake Corporation

Di-Acro Houdaille, Houdaille Industries Inc.

Educational Machinery Corp.

Kansas State Department of Education - Plastics for Industrial Arts

McNeil Akron, Inc.

Newbury Industries, Inc.

Sterling Extruder Corp.

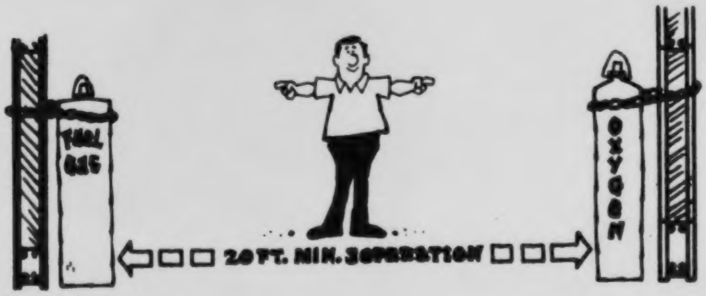
Society of Plastics Engineers, Inc.

Society of Plastics Industry, Inc.

WELDING EQUIPMENT

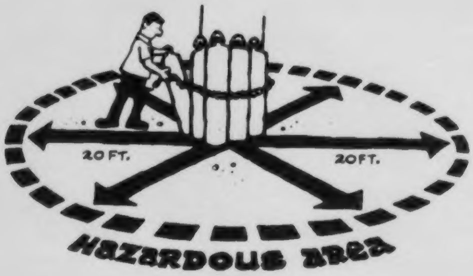
GAS WELDING, CUTTING, AND BRAZING (OSHA/NIOSH)

1. Oxygen cylinders in storage are required to be separated from fuel-gas cylinders or other combustible materials at a minimum distance of 20 feet or by a noncombustible barrier at least five feet high.

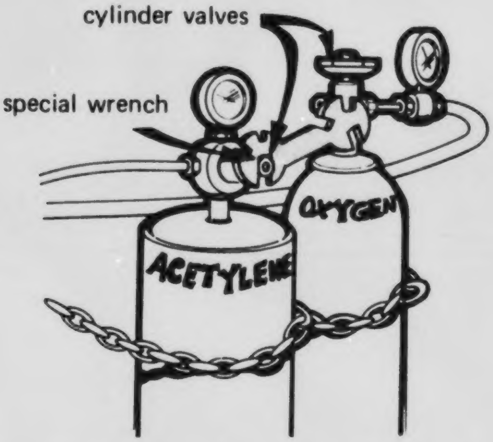


2. All cylinders shall be kept away from radiators and other sources of heat. Keep any burning substance or combustible materials away from oxygen supplies and post "No Smoking" signs.

3. All cylinders stored inside buildings are located in a well-protected, well-ventilated, dry location at least 20 feet from highly combustible materials and away from elevators, stairs, or gangways. They are not to be kept in unventilated enclosures such as lockers and cupboards.


20 FT.
20 FT.
HAZARDOUS AREA

4. All cylinder valves must be closed when work is finished. Where a special wrench is required it must be left in position on the stem of the valve while the cylinder is in use so that the fuel-gas flow can be quickly turned off in case of emergency. In the case of manifolded or coupled cylinders at least one such wrench must always be available for immediate use.



5. All cylinders should be legibly marked to identify contents.

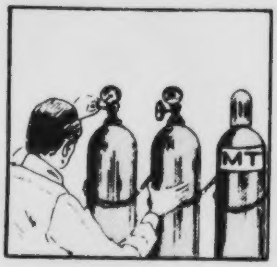
6. No cylinder is permitted to stand alone without being secured with lashing or chain to prevent it from toppling over.

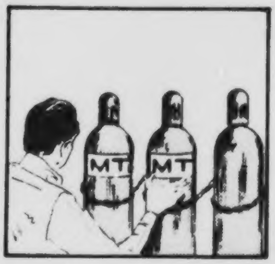
7. Acetylene shall not be used at a pressure in excess of 15 psi gauge, or 30 psi absolute.

8. Indoor storage of compressed gas shall be limited to total capacity of 2,000 cubic feet or 300 pounds of liquified petroleum gas.

9. Do not leave pressure in the hoses when leaving the area. Shut off the oxygen and acetylene at the cylinder.

10. Mark empty tanks "MT," close the valves, and replace valve caps securely.

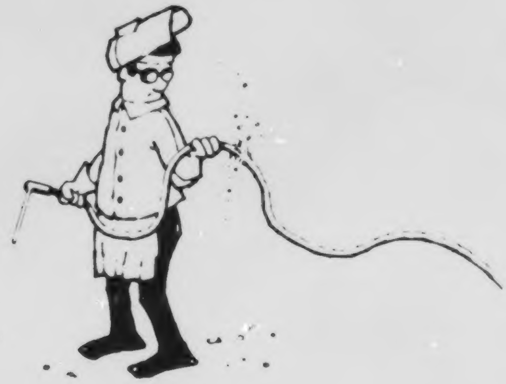




11. Empty cylinders shall have their valves closed and the valve protection caps shall be in place.

12. Oxygen cylinders or apparatus shall be kept free from oily or greasy substances and shall not be handled with oily hands or gloves.

13. An oxygen-fuel gas welding hose showing leaks, burns, worn places, or other defects rendering it unfit for service is to be repaired or replaced.



14. Gas cylinders shall be kept far enough away from the actual welding or cutting operation that sparks or hot slag will not reach them.

15. Gas cylinders shall not be placed where they might become part of an electric circuit.

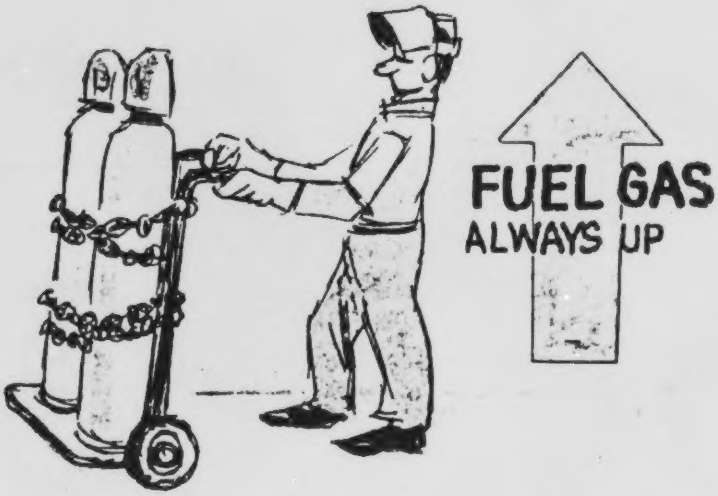
16. Gas cylinders shall never be used as rollers or supports, whether full or empty, and the number and markings stamped into cylinders shall not be tampered with.

17. Only the owner of the cylinder or person authorized by him/her shall refill a cylinder.

18. Unless it is connected to a manifold, the oxygen from a cylinder shall not be used without first attaching an oxygen regulator to the cylinder valve.

19. Gas cylinder valves shall not be tampered with nor shall any attempt be made to repair them.

20. Fuel gas cylinders shall be placed with the valve end up, whenever they are in use. All cylinders (particularly acetylene), in use should be securely retained in an upright position to prevent accidents. A non-vertical position of an acetylene cylinder in use would allow the discharge of acetone through the welding or cutting torch, clogging the mixer passages, creating a fire hazard, reducing the efficiency of the flame and contaminating the weld area.



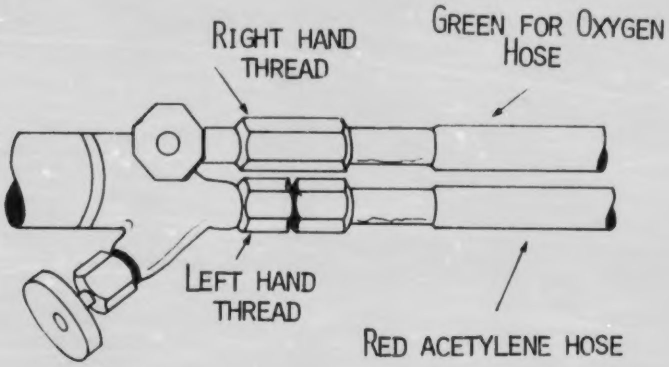
21. Before a person connects a regulator to a cylinder valve, he/she must see that the valve is opened slightly and then closed immediately to blow off sediment in the connection.

22. Before a regulator is removed from a cylinder valve, the valve shall be closed and the gas released from the regulator.

23. Nothing which may damage the safety device or interfere with the quick closing of the valve shall be placed on top of an acetylene cylinder when it is in use.

24. Fuel gas shall never be used from cylinders without reducing the pressure through a suitable regulator.

25. An acetylene cylinder valve shall not be open more than one and one half turns; preferably no more than three fourths of a turn. The generally recognized colors for welding hoses are: red for acetylene, green for oxygen hose, and black for inert gas and air hose.


RIGHT HAND THREAD
GREEN FOR OXYGEN HOSE
LEFT HAND THREAD
RED ACETYLENE HOSE

26. When parallel lengths of oxygen and acetylene hoses are taped together, not more than four inches out of twelve inches shall be covered by tape.

27. Acetylene generators shall be of approved construction and shall be plainly marked with the maximum rate of acetylene in cubic feet per hour for which they are designed, and the weight and size of carbide necessary for a single charge.

OXY-ACETYLENE WELDING

SETTING-UP PRECAUTIONS

1. Before connecting a regulator to a gas cylinder, open cylinder valve momentarily (called "cracking cylinder valve") to blow out any accumulated particles of dirt, dust, etc. which may have lodged there in transit. Do not stand in front of valve outlet when operating cylinder valve.

2. The regulators must be connected to the cylinders, making sure the connecting nuts are secured tightly to prevent leaks.

3. The pressure-adjusting screw of the regulators should be turned out until it is loose, to avoid pressures rupturing the diaphragms.

4. One should always stand to one side or away from the gauge face of the regulators when opening the cylinder valves.

5. The cylinder valves should never be opened suddenly, as the rush of high pressure may injure the regulator mechanism.

6. When oxygen cylinders are in use, the cylinder valve should be opened all the way to prevent leaks.

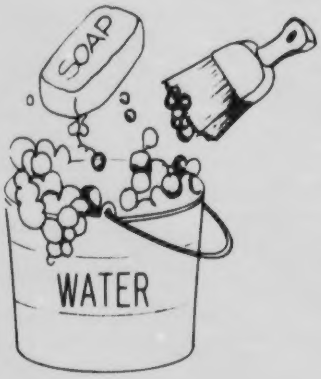
7. When acetylene cylinders are in use, the cylinder valve must not be opened over one half turn so it can be secured quickly.

8. If the acetylene cylinder valve is operated by a "T" handle wrench, the "T" wrench should always be left in place while the cylinder is in use, so the cylinder can be secured quickly in an emergency.

9. Oxygen and acetylene hoses must never be interchanged as it may cause a fire and/or explosion.

10. When damaged nuts or connections are found, they shall be removed from service.

11. When one is testing the equipment for leaks, soapy water should be used (a grease-free soap is recommended).



12. Oil or grease must never be allowed to come in contact with oxygen under pressure.

13. Oxygen must never be used as a substitute for compressed air.

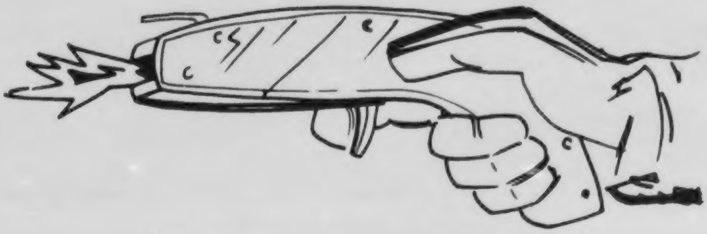
14. A person who is starting to weld or cut should make certain there is no material that flames, or sparks; hot slag or hot metal might ignite.

15. The proper size tip and the proper gas pressures should always be used.

16. Goggles should always be worn when working with a lighted torch.

17. A clear space should be kept between the cylinders and the work.

18. Matches must not be used for lighting torches.



USE A FRICTION LIGHTER TO LIGHT BLOWPIPE. YOU MIGHT GET A BAD BURN IN TRYING TO USE A MATCH.

19. Acetylene must never be released where it might be the cause of a fire or explosion.

20. Fittings must be securely connected before anyone uses the equipment.

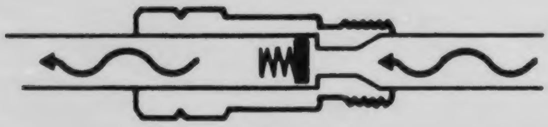
21. The torch and hose must not be hung on regulators or cylinder valves.

22. An oxygen regulator must never be connected to a cylinder containing combustible gas.

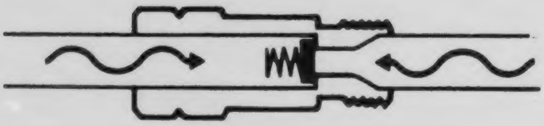
23. One should not experiment with regulators or torches nor alter them in any way.

24. All oxy-acetylene operations should be under the supervision of trained and qualified personnel.

25. Safety reverse flow check valves must be installed on the outlet nipple of the oxygen and fuel regulators to prevent reverse flow.



NORMAL FLOW



REVERSE FLOW STOPPED

WELDING AND CUTTING

1. Special care should be exercised when working in a confined space (proper clothing, ventilation, etc.).
2. Free oxygen must never be introduced to use into a confined space (for breathing), as it supports and accelerates combustion.
3. Good ventilation is necessary when welding or cutting brass, bronze, galvanized iron, etc.
4. A suitable air line mask should be worn when cutting iron or steel coated with lead, or with paint containing lead.
5. Particular caution should be exhibited when welding or cutting in dusty or gaseous locations.
6. Containers that have held a flammable substance should never be cut or welded until they have been thoroughly cleaned and safeguarded.

7. Jacketed containers or other hollow parts must be sufficiently vented before heating, welding, or cutting.
8. Cylinders, hoses, and the operator must be protected when flame cutting.
9. Stud ends of welding rods must not be dropped on floors or decks.
10. The bushings in the castings should be removed before heating the castings.
11. One should never weld or cut on bulkheads until a careful inspection of the opposite side is made and sufficient fire watches are available.
12. Protective clothing should be worn at all times. Sleeves should be kept buttoned about the wrist. Collars should be kept buttoned.

13. Fire-resistant gauntlet gloves should be used at all times.

14. Front pickets and cuffs on overalls should be eliminated.

15. The proper shade lens should be worn during all welding and cutting operations.

16. Helmets and goggles should be checked frequently for light leaks, cracks, and missing cover lens.

FIRE PREVENTION

1. Cutting or welding torches should never be used where sparks or an open flame of any kind would be a hazard.

2. Cutting or welding work must be taken to a location where there will be no possibility of setting fires.

3. If flammable materials cannot be moved, sheet metal should be used to keep the sparks close to the work being done.

4. A person who is welding or cutting on a wooden deck or floor should sweep it clean and wet it down before starting work.

5. A person who is starting to cut off a piece of steel should make sure it will not drop where there is a possibility of starting a fire.

6. When one is welding close to wooden construction it should be protected from direct heat.

7. A person who is welding near materials that will burn should be ready to promptly put out any fire, using fire extinguishers, water, or sand.

8. If there are sprinklers, this protection should be maintained without fail while cutting or welding is being done.

9. If there is a possibility that a smoldering fire may have been started, a worker should be kept at the scene of the work for at least half an hour after the job is completed.

10. Heavy cutting sparks sometimes fly 25 to 30 feet and hold their heat for several seconds after landing. This is an important fact to keep in mind!

OXYGEN-ACETYLENE MANIFOLDS

OSHA Regulations

1. An oxygen manifold to which cylinders having an aggregate capacity of more than 6,000 cubic feet of oxygen are connected shall be located outdoors.

2. Master shut-off valves for both oxygen and fuel gas shall be provided at the entry end of the portable outlet header.

3. When acetylene cylinders are coupled, approved flash arrestors shall be installed between each cylinder and the coupler block.

4. Each fuel gas cylinder head shall be provided with a backflow check valve.

5. Protective equipment shall be installed in the fuel gas piping to prevent the backflow of oxygen into the fuel gas supply system, the passage of the flashback into the fuel gas supply system, and excessive back pressure of oxygen into the fuel gas supply system.

6. Stations equipped with approved backflow and flashback devices may have as many as four torches supplied from one station outlet, with each outlet supplied with a shut-off valve.

7. Oxygen manifolds shall be separated from fuel-gas cylinders or combustible materials (especially oil or grease), a minimum distance of 20 feet or by a noncombustible barrier at least 5 feet high having a fire-resistance rating of at least one-half hour.

8. Piping and fittings shall comply with Section 2, Industrial Gas and Air Piping Systems, of the American National Standard Code for Pressure Piping ANSI B31.1, 1967 insofar as it does not conflict with subdivisions (i) and (ii) of the subdivision: (i) Pipe shall be at least Schedule 40 and fittings shall be at least standard weight in sizes up to and including 6-inch nominal. (ii) Copper tubing shall be types K or L in accordance with the Standard Specification for Seamless Copper Water Tube, ASTM B88-66a.

9. Acetylene and liquified fuel-gas cylinders shall be manifolded in a vertical position.

GRINDING WHEELS

GRINDING WHEEL
INSTITUTE

Inspection Before Storage

Grinding wheel manufacturers use every precaution to make sure that wheels are in perfect condition before being packed, and great care is used in packing. However, due to the possibility of mishap in transportation, it is important that all wheels be carefully inspected as soon as possible after receipt. A damaged container is an indication that the shipment has met with a mishap and may or may not be an indication that the contents have been damaged. However, a wheel can be damaged by an accident or by abuse in transit without any external damage to the container. Therefore, all wheels should be carefully inspected when received regardless of the condition of the container.

Wheels should be unpacked carefully, and not dumped onto the floor. Each wheel should be inspected visually for cracks, chips or other defects. It should then be given a "ring test."

STORAGE

When grinding wheels are not in use they should be carefully stored to protect them against chipping or breakage and to allow efficient and convenient removal. This applies to partly used wheels as well as to new wheels.

Grinding wheel storage racks should be so designed, constructed, and located as to best fulfill the needs of the user. The following suggestions are general in character and based on methods in common use in the plants of many large users of grinding wheels, as well as in the stock-rooms of grinding wheel manufacturers and their distributors.

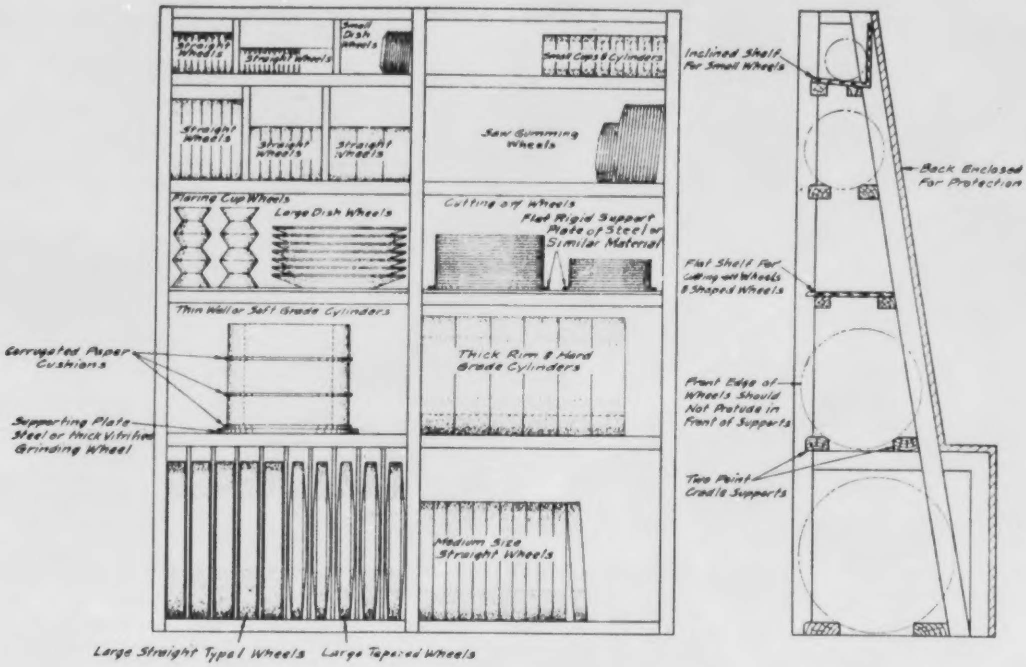
LOCATION OF STORAGE

All grinding wheels should be stored in a dry area in rooms not subject to high humidity, freezing temperatures, or extreme temperature changes. Some bond types may be seriously affected by dampness and temperature changes. The importance of storage in a dry room cannot be over-emphasized. Racks should never be located where there is danger of damage from passing trucks, crane loads, et cetera.

RACK CONSTRUCTION

The racks, bins or drawers should be constructed to accommodate each of the various types of wheels stored and of ample strength to carry the loads imposed. Each separate section of the storage rack should be constructed so as to keep the wheels from rolling off. The Figure below illustrates the principles of good rack construction.

MARKING OF RACKS--Racks should be plainly marked with the complete identification of the wheels stored, including the date received, so that the oldest wheels can be selected and used first.


Straight Wheels
Straight Wheels
Small Dish Wheels
Small Cups & Cylinders
Straight Wheels
Straight Wheels
Straight Wheels
Saw Gumming Wheels
Flaring Cup Wheels
Large Dish Wheels
Cutting off Wheels
Flat Rigid Support Plate of Steel or Similar Material
Thin Wall or Soft Grade Cylinders
Corrugated Paper Cushions
Supporting Plate Steel or thick Vitrified Grinding Wheel
Thick Rim & Hard Grade Cylinders
Medium Size Straight Wheels
Large Straight Type1 Wheels
Large Tapered Wheels
Inclined Shelf For Small Wheels
Back Enclosed For Protection
Flat Shelf For Cutting off Wheels & Shaped Wheels
Front Edge of Wheels Should Not Protude in Front of Supports
Two Point Cradle Supports

STORAGE RACKS

ORDER OF STORAGE

Wheels of the same size, type, and specifications should be stored together partitioned from any others. Then any wheel needed from storage can be taken from the end if they are stored on edge (see illustration Straight Wheels), or from the top if they are stored in stacks (see Cup and Dish Wheels). Eliminating the necessity for digging into the middle of a row or stack of wheels reduces the amount of handling and lessens the possibility of chipping or breakage. Storage should be arranged to facilitate the selection of the oldest wheels of each kind first.

STRAIGHT AND TAPERED WHEELS--Most straight and tapered wheels are best supported on edge in racks. Such racks should be made to provide two-point cradle support for the wheel to prevent rolling and with a sufficient number of partitions to prevent wheels from tipping over. Individually partitioned stalls for each wheel are recommended for wheels of unusual shape or large diameter thin Type 1 (Straight) wheels, for example 30" x 1 1/2" or 20" x 1". (See illustration- Large Straight and Tapered Wheels.)

THIN ORGANIC BONDED WHEELS--Thin organic bonded wheels should be laid on a flat rigid horizontal surface, away from excessive heat, to prevent warpage, and excessive moisture to prevent deterioration. A heavy steel plate of the same diameter or larger than the wheel makes a good foundation for stacking. A similar plate placed on the top of the stack will help prevent warpage. Blotters should not be allowed between stacked thin wheels. If thin wheels are supplied with blotters attached, suitable separators should be used to preserve flatness.

CLOTH BACKED THIN DISCS--Cloth backed thin discs should be supported and weighted as described in paragraph for thin organic bonded wheels and should be stacked cloth to cloth and grain to grain to avoid damaging the cloth backing. This will also prevent warpage.

CYLINDER, CUP AND SAUCER WHEELS--Cylinder wheels and large straight cup wheels may be stacked on the flat sides with corrugated paper or other cushioning material between them; or they may be stored in racks similar to those used for large straight wheels. A satisfactory method of storing large flaring cup wheels is to place them flat on a horizontal shelf, alternating their positions so that they will be stacked base against base and face against face. (See illustration-Flaring Cup Wheels.) Small saucer, cup and dish wheels not having a thin easily damaged edge or rim may be stored on edge.

SMALL WHEELS--Small cup and other shape wheels such as plugs, cones etc., also small internal wheels may be stored in boxes, bins or drawers with the contents plainly labeled on the outside.

HANDLING AND INSPECTION

STRENGTH OF GRINDING WHEELS

All grinding wheels must be handled carefully. Some grinding wheels are stronger than others, but all grinding wheels can be damaged by mishandling.

The strength of a grinding wheel is determined by the operation it is designed to perform, for as the outer abrasive layer becomes dull from grinding, the dull grains must break free, exposing new cutting edges. This action must be progressive and continuous.

The several factors influencing the strength are: bond, grit size, grade, and dimensions.

Should a grinding wheel be dropped, or be suspected of damage for some other reason, it should be returned to the manufacturer for reinspection.

ANSI SAFETY CODE RULES

The American National Standard Safety Code for "The Use, Care and Protection of Abrasive Wheels" contains the following mandatory rules.

1. Handle wheels carefully to prevent dropping or bumping.
2. Do not roll wheels (hoop fashion).
3. Use trucks or suitable conveyors which provide support and protection in transporting all wheels which cannot be carried by hand.
4. Place wheels carefully on a shelf or rack or in bins, boxes, or drawers.

INTER DEPARTMENT TRANSPORTATION

When grinding wheels are removed from storage and transported from one place to another they can be very easily chipped or otherwise damaged unless proper precautions are taken. Small wheels can be moved easily in wooden boxes; and larger wheels, in trucks. Hand or electric trucks should be padded and the wheels protected from falling or from any hard or sudden blow.

VISUAL INSPECTION

The shipping container should be examined for damage and indications of abusive handling. If there is visible evidence of this, the shipment should be refused; or, if accepted, special care must be used in the inspection of the wheels.

Immediately after unpacking, all wheels should be closely inspected for cracks to make sure that they have not been damaged from handling, shipping, or other causes.

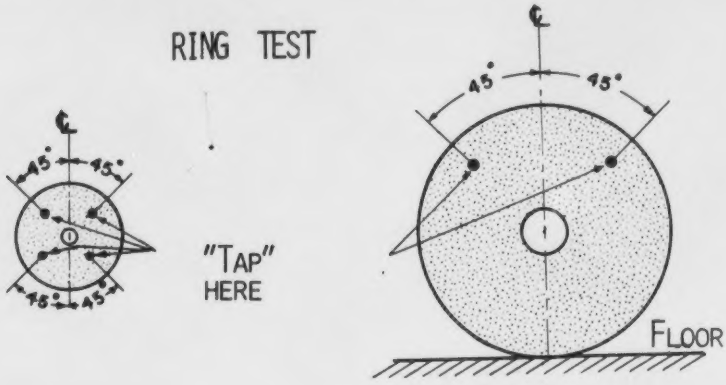
RING TEST

The wheel must be dry and free of packing material. If the wheel is not too heavy it may be suspended from the hole on a small pin or the finger. Heavier wheels may be allowed to rest in a vertical position on a clean hard floor.

"Tap" the wheel gently with a non-metallic implement such as a wooden screw driver handle for light wheels and a wooden mallet for heavy wheels. The best spot to "tap" a wheel for the ring test is about 45 degrees either side of the vertical centerline and about 1 or 2 inches from the periphery. (See Illustrations)

If struck directly along the vertical center-line, the "ring," even in a sound wheel, is sometimes muffled and may give the erroneous impression that the wheel is cracked. This is especially true with large wheels which are supported on the floor when conducting this test. (See illustration at right.) It is sometimes noticeable also when the wheel is suspended from the hole. It is recommended that the test be repeated after rotating the wheel 45 degrees to the right or left.

RING TEST



LIGHT WHEELS
SUSPEND FROM HOLE BY
SMALL PIN OR FINGER

HEAVY WHEELS
SUPPORT ON CLEAN HARD FLOOR

1. "Tap" wheels about 45 degrees either side of the vertical center-line and about 1 or 2 inches from the periphery as indicated by the spots.

2. Then rotate the wheel 45 degrees and repeat the test.

3. A sound and undamaged wheel will give a clear metallic tone. If cracked, there will be a dead sound and not a clear "ring."

Repeat this "ring test" immediately before mounting either a new or used wheel on a machine, especially if the wheel has been in storage or out of service for a considerable time.

Every wheel does not make the same sound when ring tested. There are differences in ring from one type to another. Wheels bonded with organic material do not give forth the same clear metallic ring as do vitrified and silicate wheels.

It is helpful if the characteristic ring for a certain wheel can be established. This can be done, if one or more similar wheels are "ring tested" at the same time. If any wheel sounds differently, it should be questioned.

STARTING WHEELS

The "ring test" will usually detect a cracked wheel and should be made a regular procedure but it is not a positive indication that a wheel is sound, especially if the test is performed by inexperienced personnel. Therefore, an additional "run-in" test is essential.

After mounting a wheel that has passed the "ring test," stand to one side, then run the wheel at full operating speed at least one minute before applying work. During this "run-in" test the guard should be in place.

Special care should be used where there is any suspicion that a wheel might have been dropped or subjected to any unusual impact or blow. Such wheels should be returned to the wheel manufacturer for inspection to make sure they are not damaged.

"DROP TEST" EXPERIMENT

The importance of care in handling grinding wheels of all kinds has been frequently stressed and in general, can be said to be quite widely recognized. Vitrified wheels, in particular, are usually handled with care and with the knowledge that if they are dropped or allowed to fall, they will probably break. Resinoid and rubber bonded wheels,

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however, are not always treated with the same respect. Users have learned from experience that they can apparently stand a lot of abuse, and some users have, therefore, come to consider them as virtually unbreakable. However, experiments have disclosed the fact that when such wheels land in a certain manner, it takes a surprisingly short fall to damage them so that they will subsequently fail in use.

In these experiments, a wheel such as is used on a swing frame machine for grinding steel billets was dropped flat onto a concrete floor from a height of 12 inches. This produced a crack that caused the wheel to fail in a speed test at a relatively low speed. The experiment was then repeated with several additional wheels, including variations of grade used for this class of work, and including wheels made by five different well-known manufacturers. The results were all the same. In other words, none of the wheels tested were strong enough to withstand a fall of 12 inches onto a concrete floor.

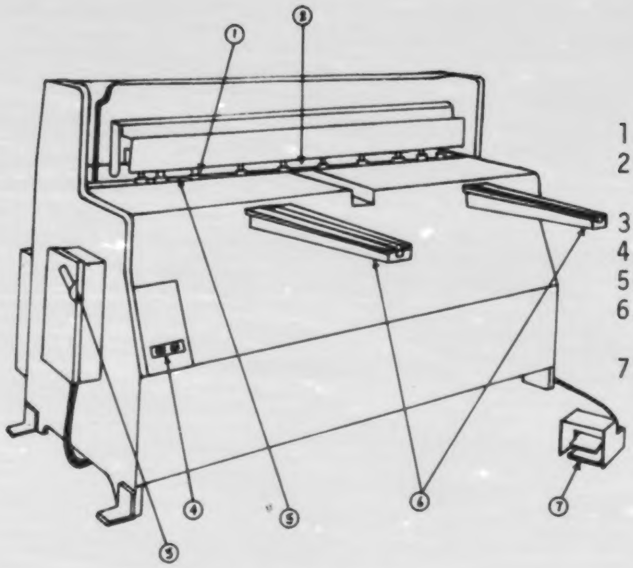
The billet grinding wheels used in these experiments were about as strong as any grinding wheels commercially made. They would normally stand very high testing speeds and would also resist considerable abuse of certain kinds. The experiments, however, proved that under certain handling conditions such wheels can be damaged.

HAZARDS CREATED BY UNUSUAL CONDITIONS

Wheels in storage are occasionally subjected to unusual conditions caused by floods, fire, escaping steam, etc. Some bond types may not be adversely affected by such exposure, while others may be rendered unsafe. When such conditions do arise, a detailed list of the wheels involved should be sent to the wheel manufacturer together with a complete report of what happened. The manufacturer may recommend that all of the exposed wheels be returned for complete reinspection.

"HANDLE ALL GRINDING WHEELS WITH CARE." REMEMBER, THERE IS NO SUCH THING AS AN "UNBREAKABLE" GRINDING WHEEL.

HYDRAULIC SHEARS



1. HOLD-DOWN PADS
2. SEE-THROUGH SAFETY GUARDS
3. TRIP SWITCH CONTROL
4. START/STOP SWITCH
5. FOUR EDGE BLADES
6. FRONT GAUGE EXTERIOR ARMS
7. GUARDED FOOT TRIP SWITCH

1. Do not prop up the hand guard while the machine is in operation. (If it is necessary to raise it, shut the motor off.)

2. Be sure the hold-down feet hold the material securely on the table.

3. Keep the hands away from the blade and hold-down feet at all times.

4. Do not exceed the maximum capacity of the machine (capacity 3/8" mild steel).

5. Do not shear round stock at any time.

6. Do not reach in from the back side of the machine.

7. Be sure that only one person at a time operates the shear.

8. Do not stack material when shearing. Shear only one thickness at a time.

9. Do not do all the cutting on the same portion of the blade. Use the entire length of the blade.

10. Always leave the control switch in the manual position.

11. Keep the floor around the machine clear of obstructions.

12. Never leave extra material, tools, etc., on the table while the hydraulic shear is in use.

13. Always put away the unused material.

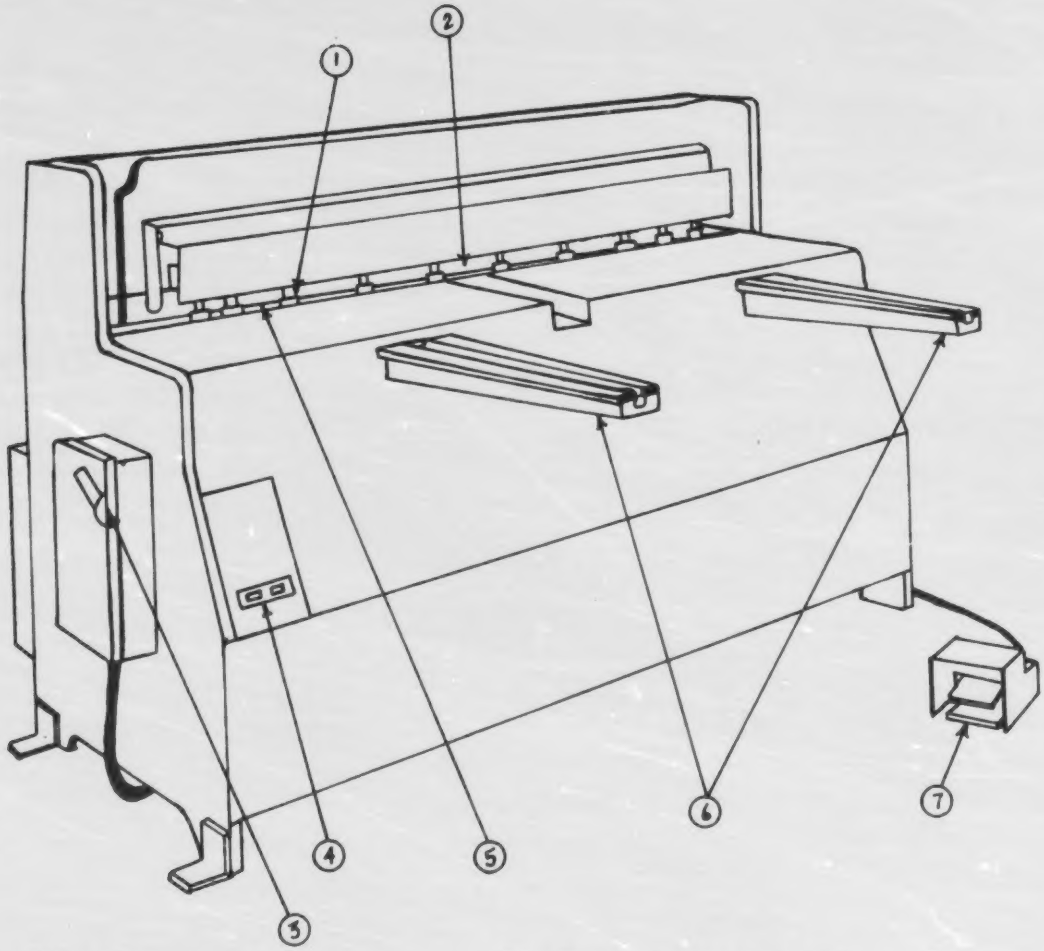
14. Pick up all the material that has been sheared.

15. Turn off the light when finished with the machine.

16. Turn off the machine upon completion of a job.

17. When in doubt, consult a teacher.

HYDRAULIC SHEARS



1 Hold-down pads

2 See-through safety guards

3 Trip switch control

4 Start/stop switch

5 Four edge blades

6 Front gauge exterior arms

7 Guarded foot trip switch

HYDRAULIC SHEARS SAFETY QUIZ

NAME________________________________

CLASS_______________________________

DATE________________ GRADE____________

True-False:

T F 1. The shear must have a see-through safety guard as part of its safety equipment.

T F 2. There are only two switches that activate the machine.

T F 3. One half inch steel may be cut on the machine.

T F 4. Round stock is never to be cut on the machine.

T F 5. The machine does not need to be well lighted when used.

T F 6. For special operations, the hand guard may be propped up.

T F 7. One of the rules of safety is never reach in from the back side of the machine.

T F 8. Always leave the control switch in the manual position.

Multiple Choice:

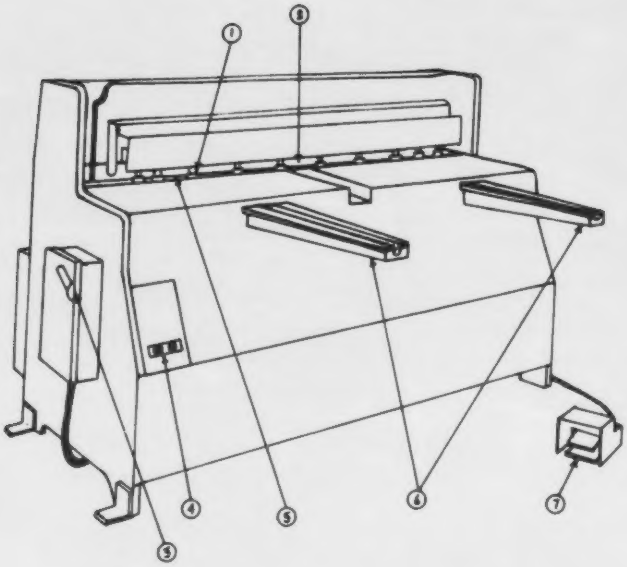
________9. The shear must be operated by:

A. several pupils at once.
B. an advanced pupil and the shop supervisor.
C. one pupil and a helper.
D. only one person at a time.

_______10. When using a shear, one should keep the fingers:

A. near the clamp and blade.
B. under the clamp and blade.
C. away from the clamp and blade.
D. between the clamp and the blade.

Write the correct name of each part in the space provided below.



1. ______________________________

2. ______________________________

3. ______________________________

4. ______________________________

5. ______________________________

6. ______________________________

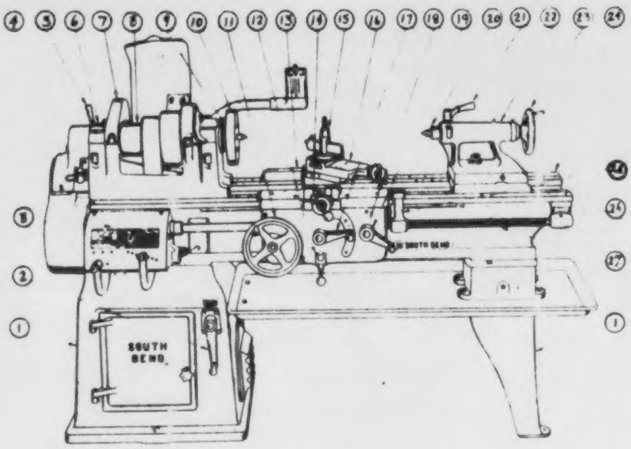
7. ______________________________

Signed ______________________________
Pupil

____
Teacher

Date ______________________________

LATHE



1 Leg
2 Belt lever
3 Gear box
4 Feed reverse lever
5 Back gear lever
6 Headstock
7 Back gears
8 Cone pulley
9 Headstock spindle
10 Face plate
11 Apron hand wheel
12 Apron feed
13 Saddle
14 Cross feed ball crank
15 Tool post
16 Compound rest
17 Feed change
18 Apron
19 Half-nut lever
20 Tailstock spindle
21 Tailstock lever
22 Tailstock
23 Tailstock hand wheel
24 Bedways
25 Thread dial
26 Rack
27 Lead screw

1. Wear appropriate eye protection.
2. Roll the sleeves above the elbows and remove or fasten any loose clothing.
3. Check to see that all guards are in place.
4. Be sure that all parts of the carriage will clear any rotating part during the full length of the cut.
5. Do not start the lathe if there are any operating knobs or levers that are not understood. Investigate, while slowly turning the lathe by hand.
6. Make all adjustments only when the machine is at a dead stop.
7. Remove the chuck key or wrench immediately after using.
8. Work alone at the machine. It should be started and stopped by only one person.
9. Be sure that the cutting tool is set on the exact center of the work. A tool set below center may grab the work, breaking the tool and/or throwing the work out of the lathe.
10. Be sure of the setup--ask if uncertain.

11. Place the hands on the controls or at one's sides except when filing or polishing.

12. Keep the hands away from chips.

13. Never try to shift the belts on the lathe while it is running. Always turn the pulleys by hand when shifting the belt.

14. Bring the lathe to a complete stop before reversing it.

15. Remove the tool holder and tool post before filing or polishing.

16. Stop the machine before attempting to measure the job.

17. Finish the cuts that are close to a chuck or against a shoulder by hand feed.

18. Have the cutter as close to the tool post as possible when the tool holder is clamped tight.

19. Do not hand stop a lathe chuck. Allow it to coast to a stop. Keep the hands away from all moving parts.

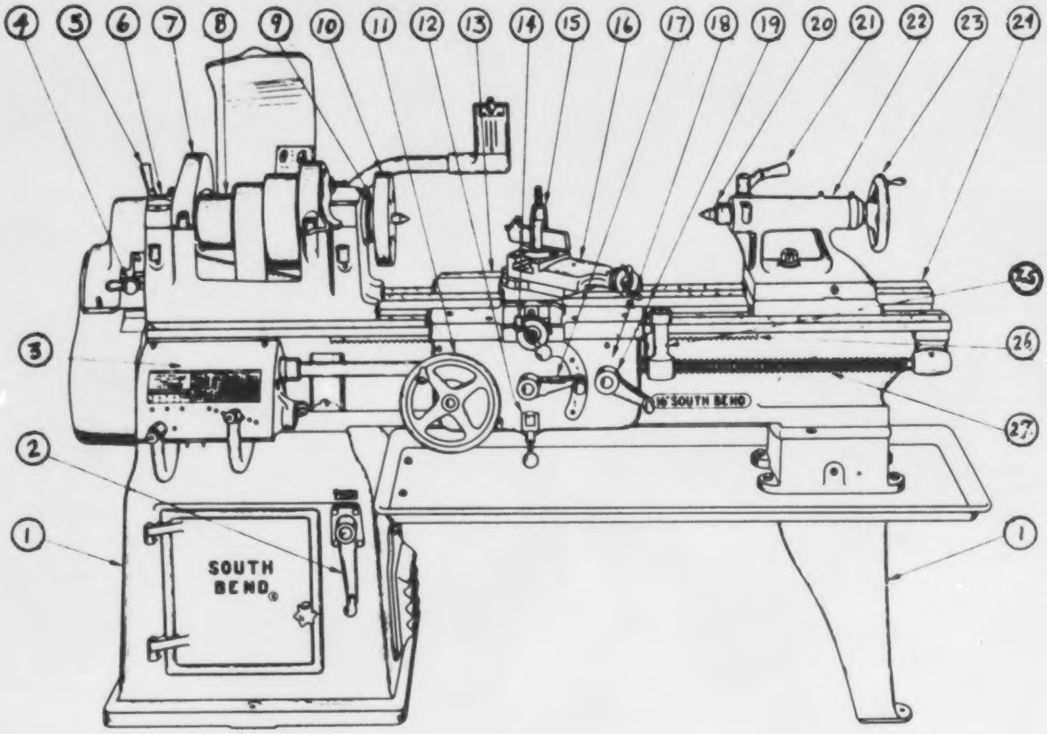
20. Never try to operate a machine and engage in conversation at the same time.

21. Don't walk away and leave the machine running.

22. Do not use air for cleaning the machine.

23. Never lay tools on the machine where they might interfere with the operation of the machine, or where they might become entangled in the work, chuck, or chips.

LATHE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SOUTH BEND
16" SOUTH BEND

1 Leg
2 Belt lever
3 Gear box
4 Feed reverse lever
5 Back gear lever
6 Headstock
7 Back gears
8 Cone pulley
9 Headstock spindle
10 Face plate

11 Apron hand wheel
12 Apron feed
13 Saddle
14 Cross feed ball crank
15 Tool post
16 Compound rest
17 Feed change
18 Apron
19 Half-nut lever

20 Tailstock spindle
21 Tailstock lever
22 Tailstock
23 Tailstock hand wheel
24 Bedways
25 Thread dial
26 Rack
27 Lead screw

LATHE SAFETY QUIZ

NAME______________________________

CLASS______________________________

DATE________________GRADE___________

(Circle true or false)

1. The chuck wrench remains in the chuck when the machine is stopped. T F
2. Measurements should be made while the machine is stopped. T F
3. The lathe must be rotating in reverse before work is cleaned with a rag. T F
4. A person should always start and stop his/her own machine. T F
5. Adjustments should be made while the machine is running. T F
6. It is safe to operate the lathe while wearing long sleeves. T F
7. All guards should be in place before the lathe is turned on. T F
8. Only tools such as a chuck key or crescent wrench should be left on the machine. T F
9. It is all right to carry on short conversations while running the lathe. T F
10. Chips may be removed with the hands only after the machine has come to a complete stop. T F
11. After the switch has been turned off, the chuck may be slowed down by hand. T F
12. The lathe should be at a complete stop before the direction of rotation is changed. T F

(Circle true or false)

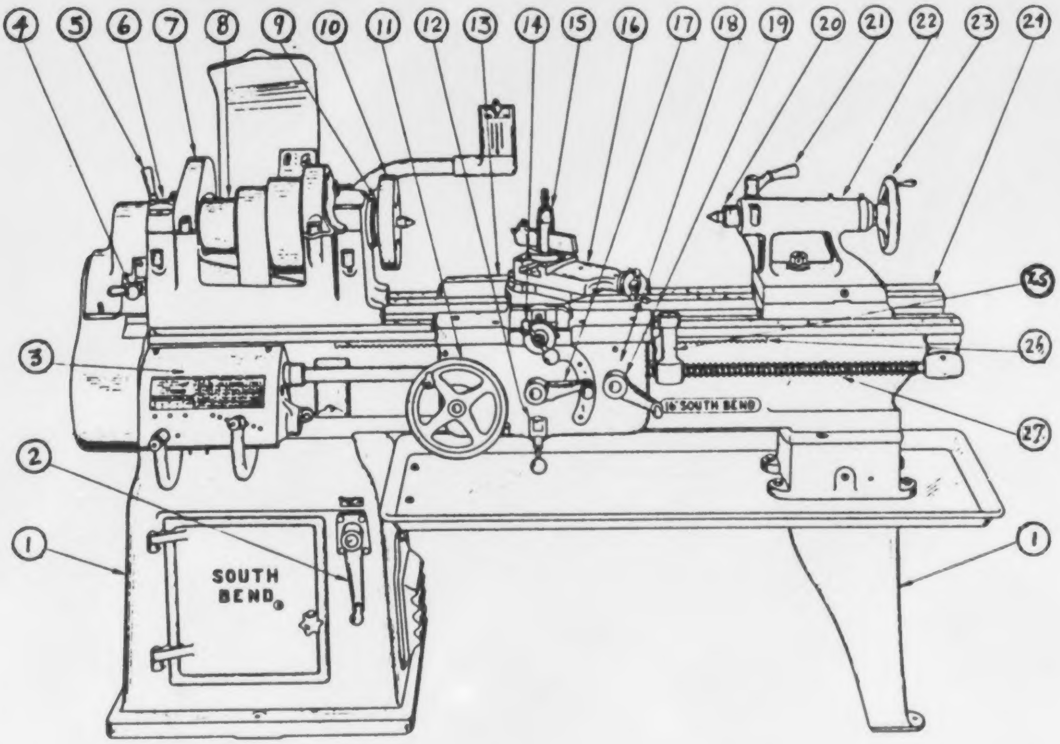
13. A lathe should never be left unattended while it is running. T F

14. After setting up the lathe, the chuck should be rotated by hand before turning on the power. T F

15. The cutting tool should be positioned just below the center of the work. T F

16. The tool post should be moved to the far end of the ways before filing or polishing. T F

In the spaces provided, identify the parts of the lathe: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SOUTH BEND
16" SOUTH BEND

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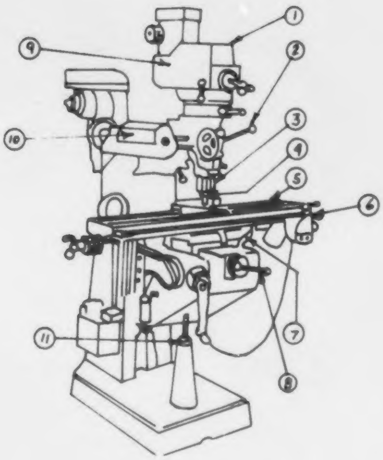
Signed ________________ ______________________ Date ______________

Pupil Teacher

MILLING MACHINE



1. HEAD
2. HAND FEED LEVER
3. QUILL
4. SPINDLE
5. TABLE
6. LONGITUDINAL FEED
7. CROSS SLIDE
8. CROSS FEED HANDWHEEL
9. GUARD
10. RAM
11. KNEE LIFT SCREW

1. The point of operation of machines (such as milling machines) where the operation exposes an operator to injury shall be guarded. (OSHA)

2. One or more methods of machine guarding shall be provided to protect the operator and other persons in the machine area from hazards. (OSHA)

3. Special tools shall be provided to assist the operator in order to avoid placing the hands in the danger zones. (OSHA)

4. Permission from the teacher must be obtained before using the milling machine.

5. Eye protection must always be worn during setup as well as operation.

6. Adjustments or setups shall be made only when the machine is at a dead stop.

7. Tie, rings, watch, and other jewelry must be removed before operating the machine. Roll sleeves up above the elbow.

8. All loose, outer clothing must be removed. Long hair shall be confined.

9. Many of the attachments used on the milling machine are very heavy; so, protective-type footwear should be worn.

10. Hearing protectors should be used where noise exceeds the level of exposure allowed in Section 1910.95 of the OSHA regulations.

11. Gloves should not be worn.

12. Correct fitting wrenches should be used on machine parts.

13. A proper cutter must be selected. It should also be sharp.

14. All cutters should be handled carefully.

15. Only a soft hammer or mallet should be used to seat work against the parallels or bottom of the vise.

16. The job should be securely fastened.

17. The machine must be set for an appropriate depth of cut.

18. A person should select a feed to match the depth of cut.

19. The handles must be disengaged when the automatic feed is to be used or the table is to be locked.

20. A person should stand to one side of the machine when starting it.

21. It is important that the cutter is turning in the proper direction.

22. Work should be fed against the rotation of the cutter.

23. When the machine is at rest, use a brush to remove chips from the work.

24. All automatic feeds should be released.

25. One should never reach over or near the rotating cutter.

26. The milling machine must not be left unattended while it is turned on.

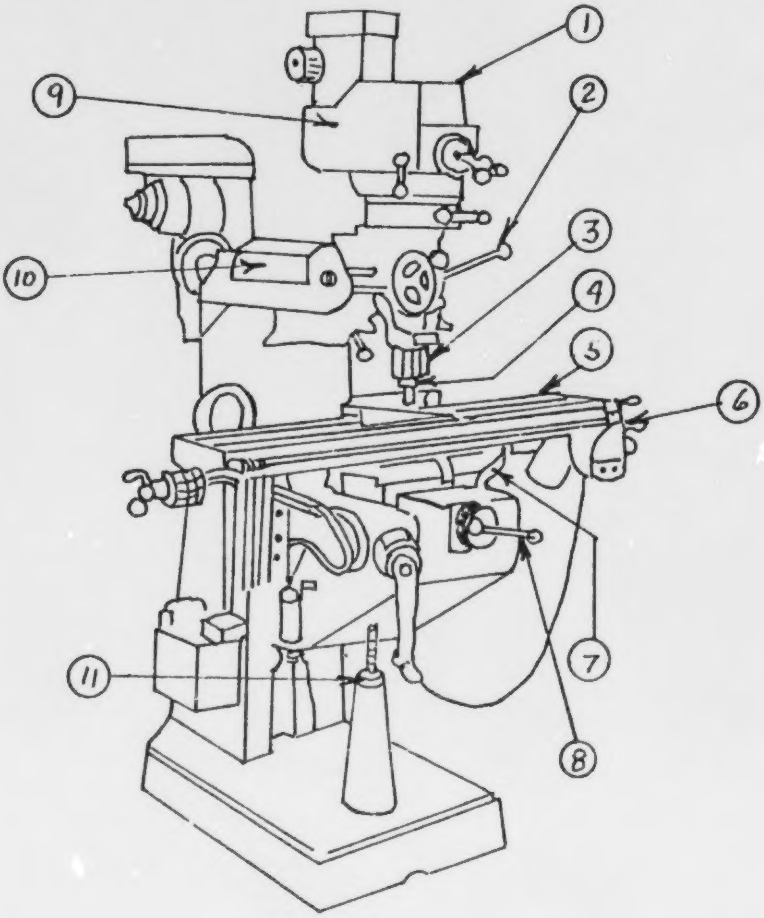
27. When a chuck key is used, it should be removed from the chuck before the spindle is started. (This is upon the completion of locking or unlocking.)

28. Only the person operating the machine should be in the safety zone.

29. The floor around the machine should be kept clear of chips, and spilled cutting fluid should be wiped up immediately.

30. A person should not talk to anyone while operating the machine, nor allow anyone else to turn on the machine being used.

MILLING MACHINE



1 HEAD
2 HAND FEED LEVER
3 QUILL
4 SPINDLE
5 TABLE
6 LONGITUDINAL FEED
7 CROSS SLIDE
8 CROSS FEED HAND WHEEL
9 GUARD
10 RAM
11 KNEE LIFT SCREW

MILLING MACHINE SAFETY QUIZ

NAME ______________________

CLASS ______________________

DATE ______________ GRADE ________

(Circle true or false)

1. All attachments and clamps on the milling machine should be checked for tightness before turning on the power. T F

2. When the milling machine cutter is revolving, the table should be cleaned. T F

3. The striking of a mill cutter with a steel hammer may damage the hammer. T F

4. A person who has finished using the milling machine should release all of the automatic feeds. T F

5. On long cuts, it is permissible to leave the machine while it is on automatic feed. T F

6. Eye protection should be worn at all times. T F

7. The milling machine is one of the least dangerous machines to operate. Therefore, it is not necessary to ask for permission every time one uses it. T F

8. If the milling machine is equipped with a guard which interferes with a particular job or operation, it is permissible to remove it. T F

9. Gloves may need to be worn while operating the milling machine (depending on the job being done). T F

10. Long sleeves should be rolled up. T F

11. A person should ask a friend to turn the machine on for him/her in order to prevent reaching over a rotating cutter. T F

(Circle true or false)

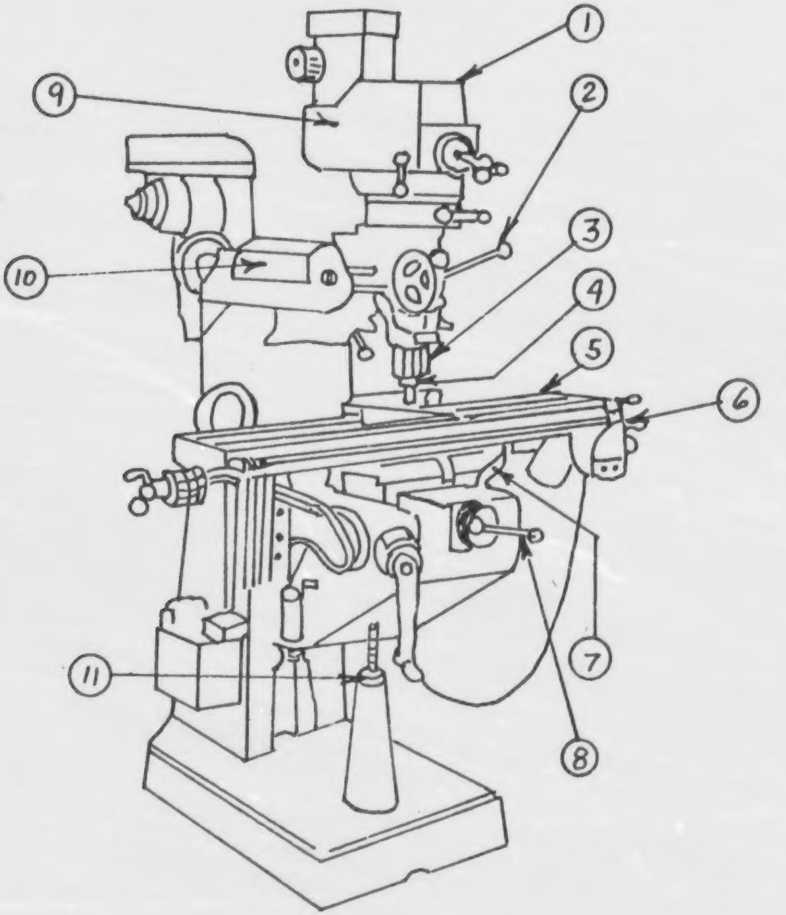
12. No more than three people should be in the safety zone at any one time. T F

13. Handles should be disengaged when the machine is on automatic feed. T F

14. No adjustments should be made while the machine is running. T F

15. For most work in the school lab, the milling machine should be set on the highest speed. T F

In the spaces provided, identify the parts of the milling machine: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Signed: ____________________
Pupil

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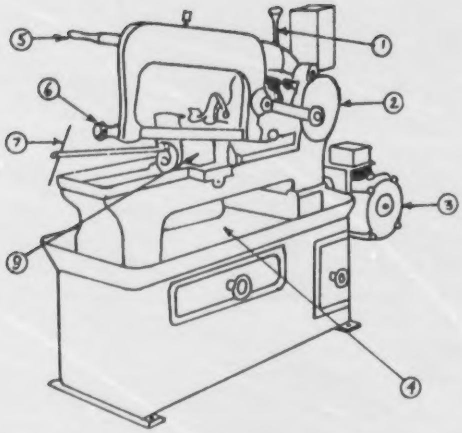
Teacher

Date: ____________________

POWER HACKSAW



1. FEED LEVER
2. FLYWHEEL
3. MOTOR
4. COOLANT RESERVOIR
5. FRAME HANDLE
6. BLADE TENSION KNOB
7. VISE HANDLE
8. VISE

1. Machines designed for a fixed location shall be securely anchored to prevent walking or moving. (OSHA)
2. Eye protection shall be worn.
3. Work shall be mounted in only when the saw is stopped.
4. Protruding ends of long pieces shall be supported so they will not fall and cause an injury.
5. It is important to guard against people walking into protruding stock.
6. Saw blades must be in good condition.
7. The speed of the blade shall be adjusted to suit the job and blade.
8. The project shall be secured in the vise.
9. The blade tension should comply with the manufacturer's recommendations.
10. The machine should be stopped for speed ajustment unless it is a varispeed machine.
11. The saw must not be operated without all the guards.
12. The saw should be stopped when the blade breaks. Then the blade should be removed.
13. The blade should be fed slowly and gradually into the work.

14. A person should never attempt to saw short pieces of stock unless he/she has another piece of the same diameter in the opposite side of the jaws. Pieces smaller than 1/4 inch should be cut manually.

15. Stand to one side of the saw frame when the power is to be turned on.

16. It is not advisable to bend over the saw while it is in operation.

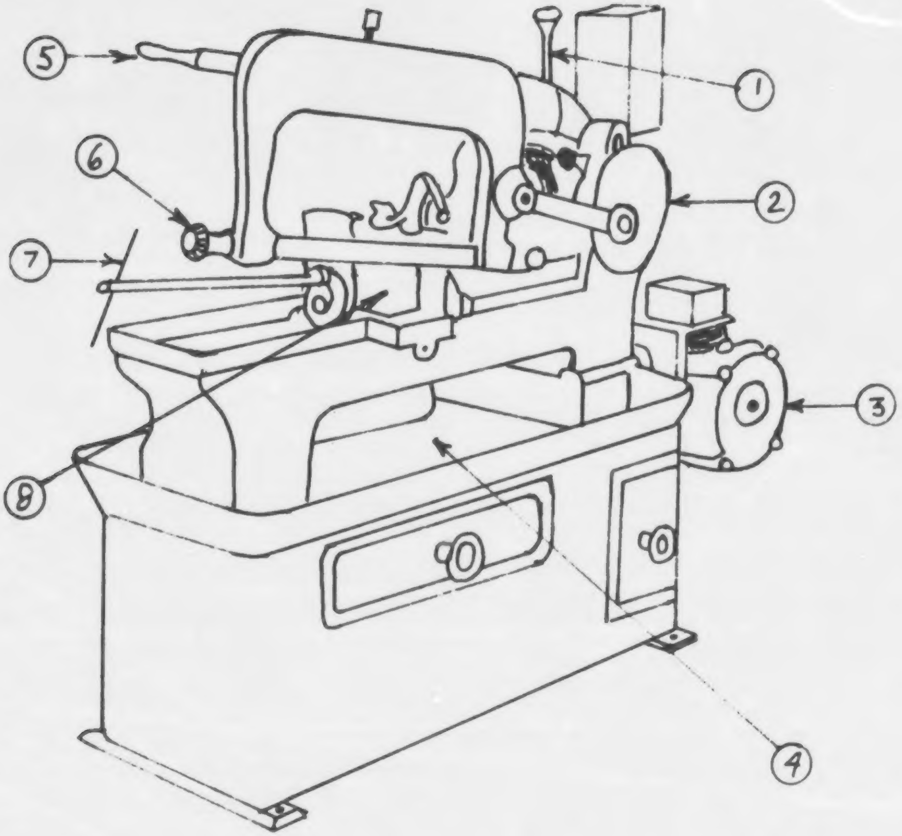
17. Hands should be kept away from the blade and the line of travel of moving parts.

18. One should turn off the power after using the power hacksaw and stand by the machine until it has completely stopped.

19. The machine and area should be cleaned with a brush.

20. Loose clothing should not be worn when a person is running the power hacksaw.

POWER HACKSAW



1 Feed lever
2 Flywheel
3 Motor
4 Coolant reservoir
5 Frame handle
6 Blade tension knob
7 Vise handle
8 Vise

POWER HACKSAW SAFETY QUIZ

NAME______________________________

CLASS______________________________

DATE_______________GRADE______________

(Circle true or false)

1. Hacksaw blades are made to cut in both directions. T F

2. If the blade is dull and cuts slowly, apply hand pressure to make it cut faster. T F

3. The blade pressure should be reduced when sawing thin metal. T F

4. Work should be mounted when the power is turned on. T F

5. If the power hacksaw begins to move or jump when in use, the operator should turn the power off immediately. T F

6. If the base of the power hacksaw begins to move or jump, the operator should turn the power off immediately. T F

7. Most hacksaw blades can be operated at the same speed. T F

8. A person who is sawing long pieces of stock should have another pupil hold one end. T F

9. The operator should stand at the end of the saw frame when the power is turned on. T F

10. The power hacksaw must always be cleaned with a brush. T F

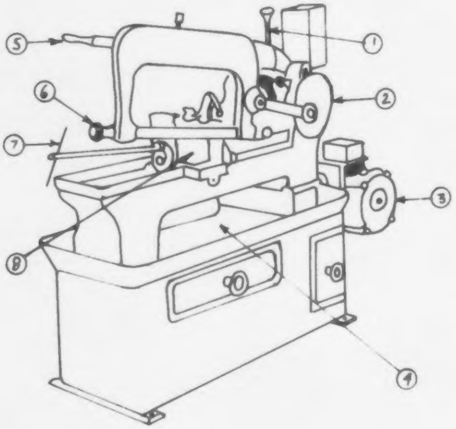
11. The blade should be fed slowly into the work. T F

(Circle true or false)

12. On some occasions, it may be necessary to hold the material with the hand while cutting with the power hacksaw. T F

13. The saw may be left unattended while it is running only if the material is greater than one inch thick. T F

14. In the spaces provided, identify the parts of the power hacksaw:



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Signed: ____________________
Pupil

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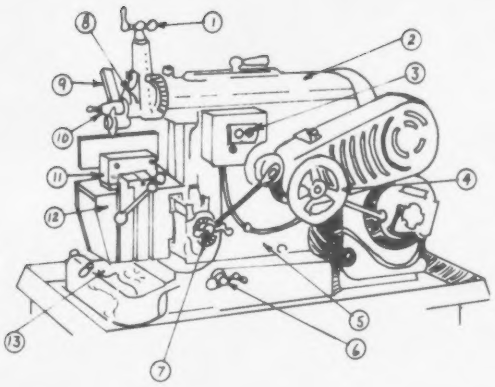
Teacher

Date ____________________

SHAPER



1. VERTICAL FEED
2. RAM
3. SWITCH
4. HAND WHEEL
5. COLUMN
6. TABLE HEIGHT ADJUSTMENT
7. AUTOMATIC FEED
8. CLAPPER BOX
9. TOOL AND HOLDER
10. TOOL POST
11. VISE
12. TABLE
13. TABLE SUPPORT

1. Wear adequate eye protection.
2. Make adjustments and measurements only when the machine is at a complete stop.
3. Keep the hands and fingers a minimum of six inches from the cutting tool and all other moving parts.
4. Avoid standing directly in front of or behind the ram.
5. Make sure the machine comes to a complete stop before leaving it.
6. Be sure the fences and guards are correctly fastened in place.
7. Remove jewelry, eliminate loose clothing, and confine long hair.
8. Do not put tools or tooling on any part of the machine.
9. Never remove chips while the machine is in motion.
10. Be sure one thoroughly understands the operation of the machine before attempting to operate it.
11. Use a soft hammer or mallet to set work on the parallels.
12. Secure the work firmly in the machine.
13. Select the proper tool for the job.

14. Set the machine for the proper depth of the cut.

15. Be sure that the ram and head will clear the work and also any holding device.

16. Check to see that the lever is in a neutral position before starting the motor.

17. Handle the cutter bit with care.

18. Making too deep a cut, or not securely clamping the work in the vise, may result in injury.

19. Make sure to use the correct stroke, speed, and depth of cut before using the shaper.

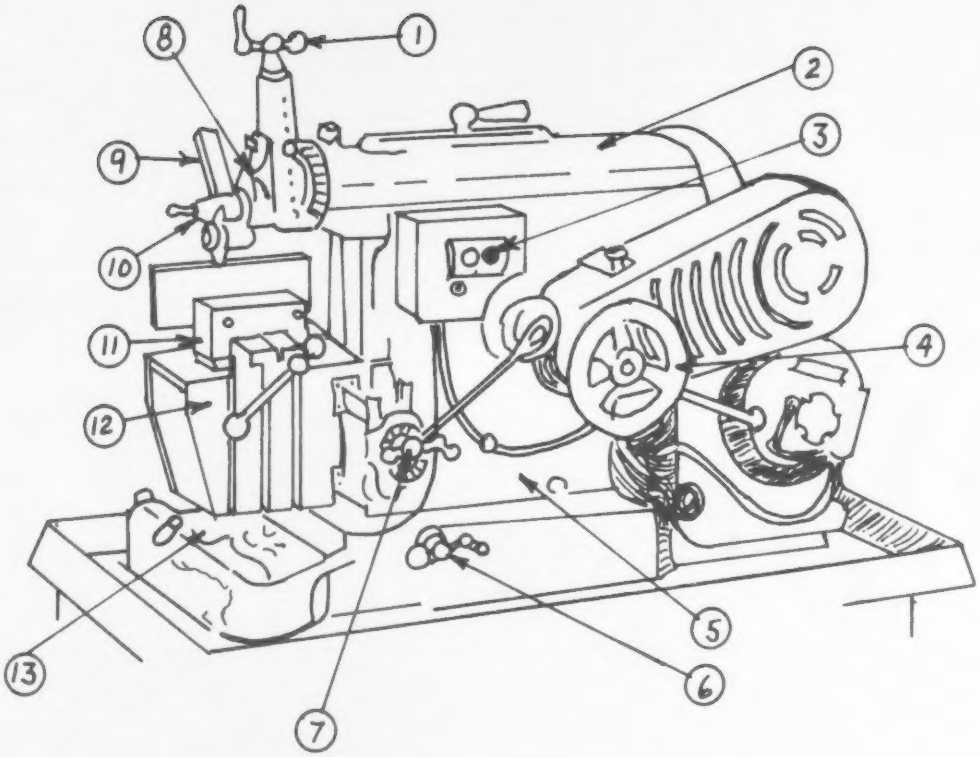
20. Make sure no one but the operator is inside the operator's zone.

21. Clean the machine and area with a brush.

22. Do not leave the shaper unattended while it is running.

23. Operate the machine only with the teacher's permission, and after instruction has been received.

SHAPER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1 Vertical feed
2 Ram
3 Switch
4 Hand wheel
5 Column
6 Table height adjustment
7 Automatic feed

8 Clapper box
9 Tool and holder
10 Tool post
11 Vise
12 Table
13 Table support

SHAPER SAFETY QUIZ

NAME______________________________

CLASS______________________________

DATE_________________GRADE____________

(Circle true or false)

1. A heavy cut may get the job done more quickly but also could be unsafe. T F

2. Chips may be removed while the machine is running. T F

3. Eye protection must be worn. T F

4. All clearances should be checked before the ram is set in motion. T F

5. It is permissible to stand in front of the machine while it is running. T F

6. All setups should be approved by the teacher. T F

7. The shaper must never be left running and unattended. T F

8. The operator can visit with others while running the shaper. T F

9. The machine and area should always be cleaned with a brush. T F

10. The lever should be in a forward position before starting the motor. T F

11. Long hair might get caught in the shaper if it isn't confined. T F

12. It's all right to lay tools on the machine. T F

13. The part should be securely held in a vise. T F

14. One can adjust the shaper while it is running. T F

(Circle true of false)

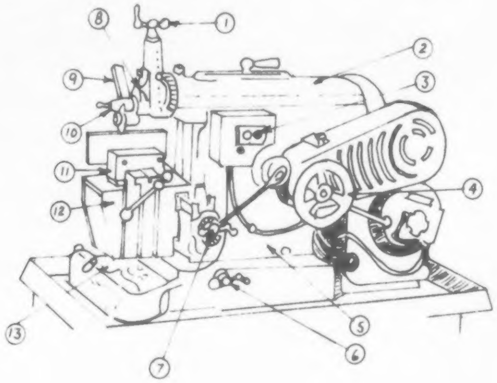
15. Fences and guards should be fastened tightly in place. T F

16. It's all right to stand in front of the ram. T F

17. It's all right to stand behind the ram. T F

18. Eye protection must be worn while running the shaper. T F

19. In the spaces provided, identify the parts of the shaper:



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Signed:

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Pupil

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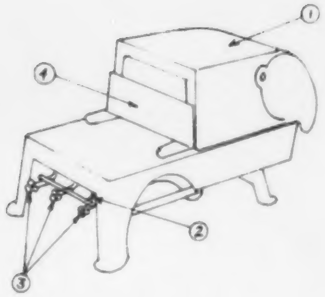
Teacher

Date ______________________

SOLDERING FURNACE



1. HOOD
2. GAS LINE PILOTS
3. GAS VALVE
4. HEAT SHIELD

1. Obtain permission from the teacher before lighting the furnace for soldering.
2. See that the area is properly ventilated.
3. Wear eye protective devices.
4. Light the furnace by following this procedure:
    - A. Stand to one side of the furnace.
    - B. Place a lighted piece of paper in the furnace if it does not have a pilot light.
    - C. Turn on the gas slowly.
    - D. Adjust the flame so that all the fire is confined within the furnace.
5. Select the correct flux for the soldering job that is to be done.
6. When using gas furnaces, keep flammables away from the area.
7. Do not carry hot soldering coppers around in the shop.
8. Keep the hands away from the eyes and mouth.
9. Avoid overheating the soldering copper. "Red" hot is too hot!
10. Never leave hot soldering coppers unattended in the furnace.
11. Put the hot soldering copper and other hot objects where people cannot be burned.

12. Keep the soldering flux in an area where it is safe from spilling.

13. Exercise special care when filing a hot soldering copper. Use a vise to hold it when filing.

14. Use care when storing the copper after use. Improper storage can result in serious burns or a fire.

15. Wash the hands thoroughly after using the soft solder and flux.

16. Tin the soldering copper in a well-ventilated area.

17. Do not touch joints that have just been soldered.

18. Store the soldering fluxes in proper containers and in a safe place.

19. Test any material around a soldering area before picking it up. It may be hot.

20. Avoid breathing the fumes from the fluxes.

21. Coppers should be put down only on insulated, nonflammable surfaces.

22. Do not allow molten solder to come in contact with wet or moist surfaces.

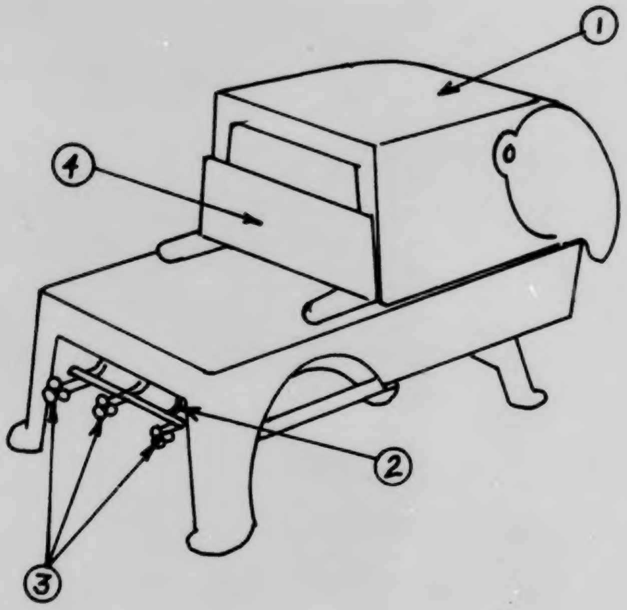
23. When using sal ammoniac, avoid inhaling the fumes.

24. Report any indication of gas escaping from the soldering furnace.

25. Never immerse the hot soldering copper in water to cool it.

26. Shut off the gas when the soldering furnace is no longer in use.

SOLDERING FURNACE



1 Hood
2 Gas line pilots
3 Gas valve
4 Heat shield

SOLDERING FURNACE SAFETY QUIZ

NAME ______________________

CLASS ______________________

DATE __________ GRADE _________

(Circle True or False)

1.	It is dangerous to use solder where parts or materials are wet or moist.	T	F
2.	It is not harmful to breathe the gases which are produced from the soldering process.	T	F
3.	Fumes from sal ammoniac may be inhaled safely.	T	F
4.	It is not necessary or wise to heat the copper to bright red.	T	F
5.	Good ventilation in the soldering area is a must.	T	F
6.	A person should look directly into the furnace when lighting it.	T	F
7.	Eye protection is necessary only when lighting the furnace.	T	F
8.	A soldering copper should always be picked up by its handle, whether it's hot or cold.	T	F
9.	Hot soldering irons should not be laid down near combustible materials.	T	F
10.	A hot soldering copper that has to be carried should be held downward, with the carrier watching and warning others nearby.	T	F
11.	The soldering iron should be cooled after use by immersing it in water.	T	F
12.	It is not harmful to touch the mouth or eyes with the hands while soldering because fluxes are nontoxic.	T	F

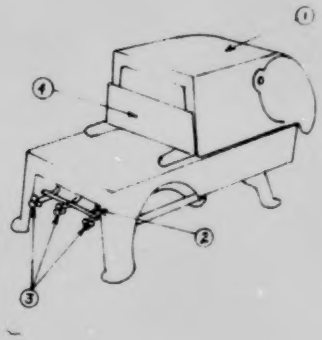
(Circle true or false)

13. There is not need for alarm if a slight gas leak is indicated. T F

14. A firm grip must be kept on the handle when filing on hot soldering copper. T F

15. All fluxes are the same. T F

16. In the spaces provided, identify the parts of the soldering furnace:



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Signed:

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Pupil

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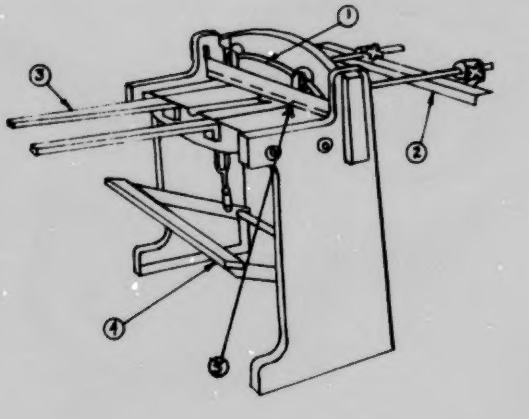
Teacher

Date____________________

SQUARING SHEAR



1. HOLD-DOWN AND GUARD
2. BACK GAUGE
3. EXTENSION ARMS
4. FOOT PEDAL
5. SEE THROUGH SAFETY GUARD

1. Never cut excessively small pieces on a shear.
2. Wear eye protection.
3. Never reach behind the shear to support the metal. This places the operator in an awkward position, subject to a fall, and also puts the operator's fingers in a blind area.
4. Use care in handling the sheared, razor-sharp metal.
5. Keep the foot that is not being used out from under the treadle.
6. Feed and operate the machine from the front or the operator's position.
7. Always keep the fingers at least four inches from the pressure bar and blade.
8. Operate the machine only with the teacher's permission and after instruction has been received.
9. When squaring, always hold the metal against the squaring bar on the left.
10. Pick up all metal scrap and place it in proper containers.

11. Get help when cutting large pieces of sheet metal.

12. Keep the floor in front of the shear clean and clear in order to avoid slipping.

13. Guards must be in place at all times, including hold-down guard and a transparent guard in front of the hold-down guard to prevent fingers from entering under the guard.

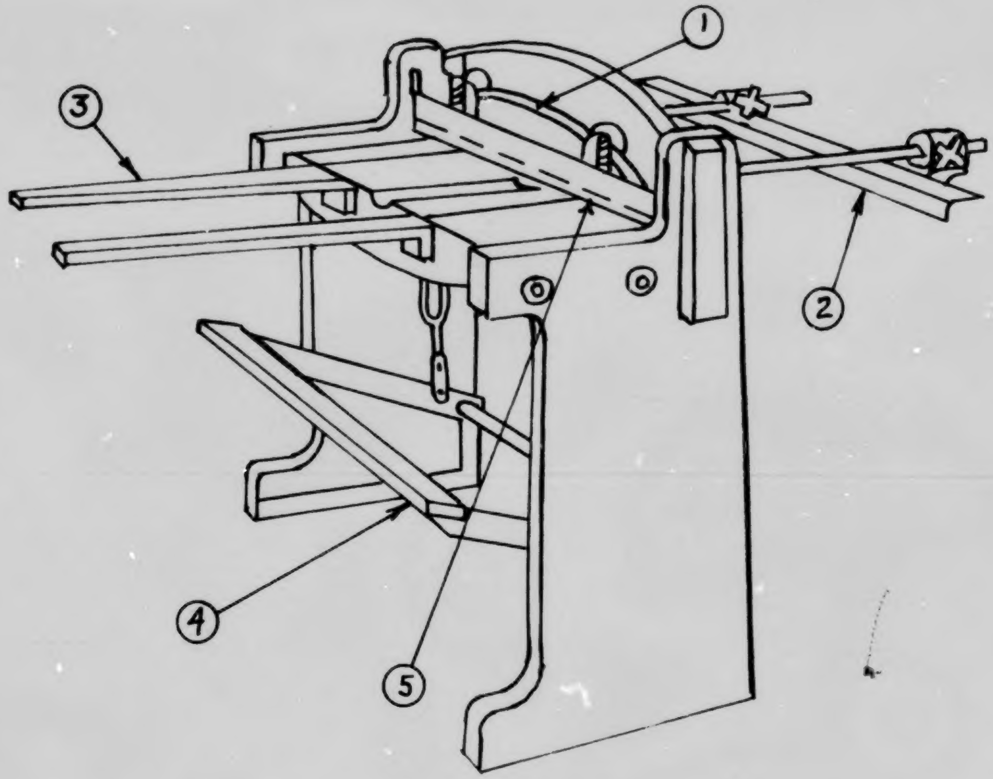
14. Do not attempt to cut narrow strips of metal lengthwise.

15. Check the setup and machine before operating it.

16. Never surpass the capacity of the machine.

17. Regulate the pressure on the treadle according to the gauge and type of stock. Keep the foot on the treadle to ease its return to a normal position.

SQUARING SHEAR



1 Hold-down and guard

2 Back gauge

3 Extension arms

4 Foot pedal

5 See through safety guard

SQUARING SHEAR SAFETY QUIZ

NAME______________________________

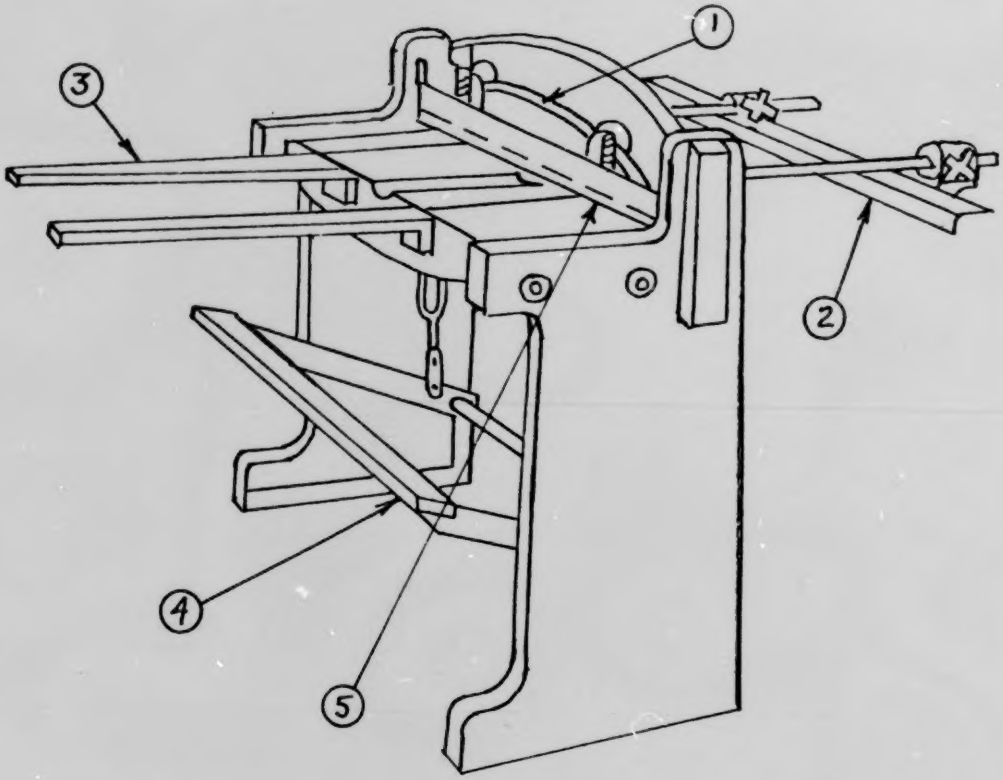
CLASS______________________________

DATE______________GRADE______________

(Circle True or False)

1. For some projects, the guard can be removed. T F
2. One should feed and operate only from the treadle side of the machine. T F
3. Eye protection is not required. T F
4. Care in handling of sheared metal should always be observed because the edges are razor sharp. T F
5. One should never reach forward enough to permit the fingers to get under the hold-down bar. T F
6. It is poor practice to jump on the treadle. T F
7. One should not bother the teacher for permission to use the shear. T F
8. The metal should be held against the squaring bar on the left side when squaring it. T F
9. Guards must not be removed from the shear. T F
10. The shear can cut any thickness of metal. T F
11. The shear does not require any adjustment before operating. T F
12. One should not attempt to cut long narrow strips lengthwise. T F
13. Both feet are needed to operate the treadle. T F

In the spaces provided, identify the parts of the squaring shear:



1 ______________________________

2 ______________________________

3 ______________________________

4 ______________________________

5. ______________________________

Signed:

____
Pupil

____
Teacher

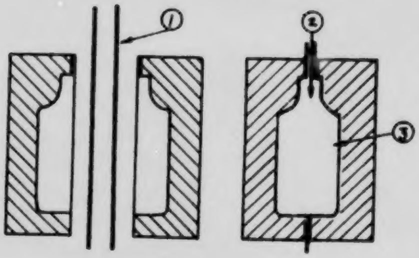
Date______________________________

REFERENCES

Materials were selected and reviewed from the following sources and in some instances were incorporated in the production of the preceding unit.

1. Baldor Electric Company
2. Bridgeport Textron Machine Division
3. Dake Corporation
4. DiAcro Houdville - Houdville Industries
5. Grinding Wheel Institute
6. K. O. Lee Company
7. McEnglevan Heat Treating Mfg.
8. NIOSH - U.S. Department of Health, Education, and Welfare
9. Ohio Industrial Arts and Vocational Education Department
10. OSHA - U.S. Department of Labor
11. Pennsylvania Industrial Arts Association and Department of Education
12. Pittsburg State University - L. Duane Griffin
13. Powermatic Tool Company
14. Rockwell Delta - Rockwell International
15. Roper Whitney, Incorporated
16. Shawnee Mission Public Schools - Bill Studwin
17. South Bend Lathe, Incorporated
18. Utah State Safety Guide
19. Washington State Industrial Arts Safety Guide
20. Wyoming State Department of Education

PLASTIC EQUIPMENT



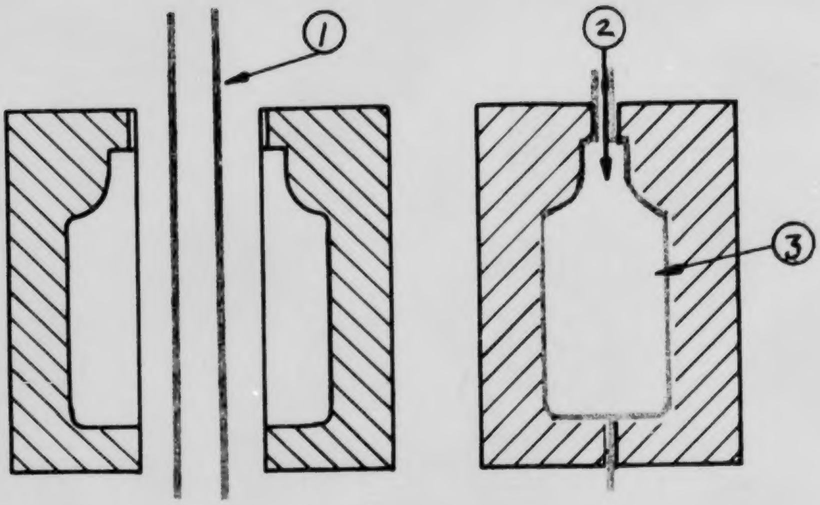
BLOW MOLD

1. PLASTIC PARISON
2. AIR PRESSURE
3. BLOWN PART

MOLD OPEN   MOLD CLOSED

1. Wear proper eye protection.
2. Wear heat resistive gloves when handling the new molded part or to guard against contact with heated parts of the machine.
3. Keep hands clear of the moving parts such as the ram on the parison extrusion area, the mold closing mechanism, and the part ejector.
4. Avoid handling electrical devices with wet hands or while standing on wet floors.
5. Keep all guards in place on the machine.
6. Maintain proper air pressure in the blow molding section of the operation.
7. Caution bystanders when purging the molding equipment.
8. Keep the area around the machine clean of scrap parts, tools, and other materials.
9. Maintain the proper temperature and time cycle to ensure safe operation of the molder.
10. Check with the teacher for clearance to operate the blow molder.
11. Beware of the moving parts of the machine that are operated by air or hydraulic pressure. Air-operated machines move much quicker and can be a hazard to the operator when not guarded properly.

BLOW MOLD



MOLD OPEN MOLD CLOSED

1 Plastic parison
2 Air pressure
3 Blown part

BLOW MOLDING SAFETY QUIZ

NAME______________________________

CLASS______________________________

DATE______________GRADE__________

(Circle true or false)

1. The parison has to be very hot when blow molding. T F

2. The state laws require the safety glasses to be worn by the operator of laboratory equipment. T F

Complete the following questions.

3. Check with the __________ for clearance to use the blow molder.

4. ______________ is an operation or step taken to clean the plastics material out of the heating area and can be a hazardous procedure.

5. Air operated machines move ______________ and can be a ______________ to the operator.

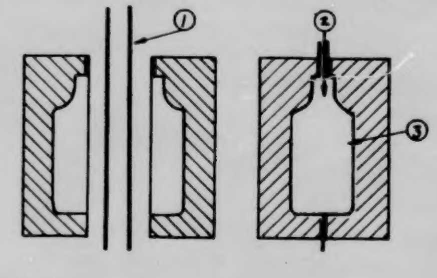
6. Caution bystanders when ______________ the machine.

7. Proper ______________ pressure must be maintained.

8. The floors must be ____________ when using the machine.

9. Keep hands clear of ______________ parts.

10. Name the parts of the mold.



1.________________________

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Signed________________________
Pupil

Date____________________

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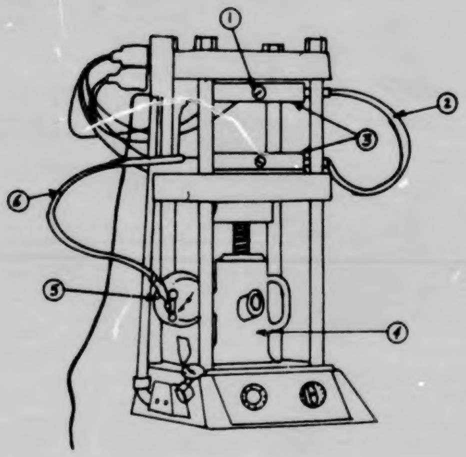
Teacher

COMPRESSION MOLDER



1. TEMPERATURE GAUGE
2. WATER LINE
3. HEATED PLATENS
4. HYDRAULIC JACK
5. PRESSURE GAUGE
6. WATER LINE

1. Wear eye protective devices.

2. Turn on heating units and wait until the gauge reads 350° before operating the machine.

3. Remember that the platens are heated and that all molds placed on the platen will have to be handled with gloves. Severe burns may result if heat resistive gloves are not used.

4. As the molds cavities are filled, use gloves to handle the mold.

5. When opening mold, use gloves to hold mold and hit mold with a wooden mallet to open.

6. Keep the mold centered in the middle of the platens.

7. Keep all guards in place.

8. Don't exceed the capacity of the molding machine.

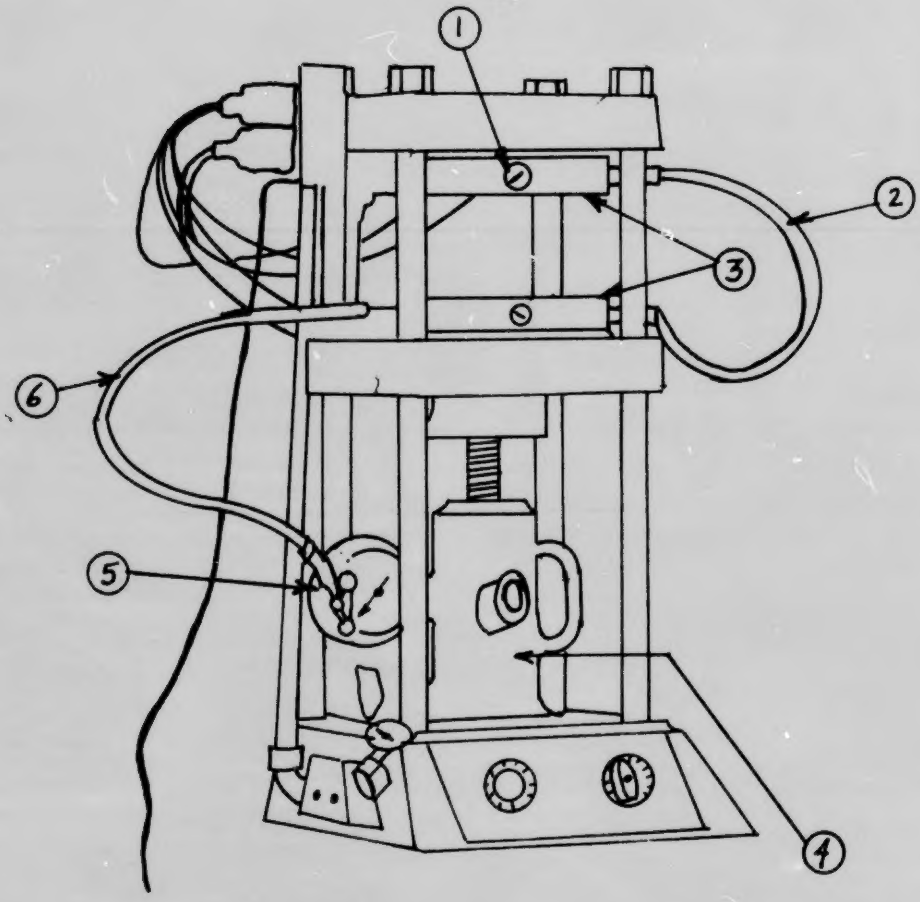
9. Do not have hands near the platens on the compression molder when the press is in operation.

10. Avoid handling electrical devices with wet hands or while standing on wet floor.

11. Provide proper ventilation.

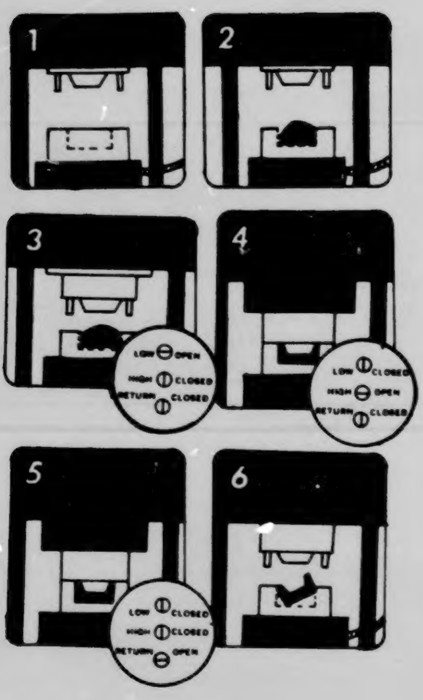
12. All material spills must be cleaned in order to prevent an accident.

COMPRESSION MOLDER



1 Temperature gauge
2 Water line
3 Heated platens
4 Hydraulic jack
5 Pressure gauge
6 Water line

COMPRESSION MOLDER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LOW OPEN
HIGH CLOSED
RETURN CLOSED
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LOW CLOSED
HIGH OPEN
RETURN CLOSED
5
LOW CLOSED
HIGH CLOSED
RETURN OPEN
6

Machine Opening and Closing

COMPRESSION MOLDER SAFETY QUIZ

NAME______________________________

CLASS______________________________

DATE______________ GRADE______________

(Circle true or false)

1.	The compression molding process is dangerous because of the high pressures that must be applied to the mold.	T	F
2.	It is not necessary to clean material spills.	T	F

Complete the following questions.

3. Wear proper______________to protect the hands because the mold and molded parts are very hot.

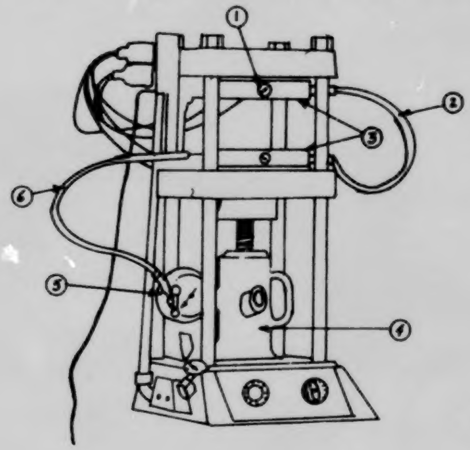
4. Keep__________centered in the middle of the press.

5. Do not exceed the ____________of the machine.

6. The molds must be centered in the ____________of the platens.

7. Handling electrical devices with__________hands is dangerous.

8. Name the parts of the machine.



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6. ______________________

Signed______________________________
Pupil

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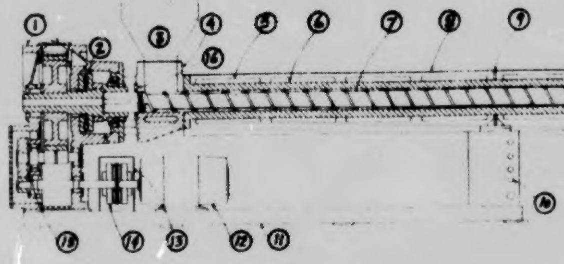
Teacher

Date______________________________

EXTRUDER



1. REDUCER
2. THRUST BEARING ASSEMBLY
3. HOPPER
4. THROAT
5. HEATERS WITH COOLING COILS
6. BARREL
7. SCREW
8. BARREL GUARD
9. BARREL SUPPORT
10. RECEPTACLES
11. BASE
12. MOTOR
13. COUPLING GUARD
14. COUPLING
15. CHANGE GEARS

1. Wear proper eye protection.

2. Wear heat resistive gloves at all times; machine parts, as well as the plastic itself, are hot.

3. Caution bystanders when purging the machine.

4. Control the operating temperature closely because the overheated plastics can be forced out in an uncontrolled manner.

5. Make sure guards are in place when operating any piece of equipment that is equipped with protective devices.

6. Avoid handling the electrical devices with wet hands or while standing on wet floors.

7. The product or extruded part will be very hot as it comes out of the machine so take cautions in handling such.

8. Check with teacher for clearance to operate the extrusion machine.

9. Check for proper ventilation when heating some plastics materials.

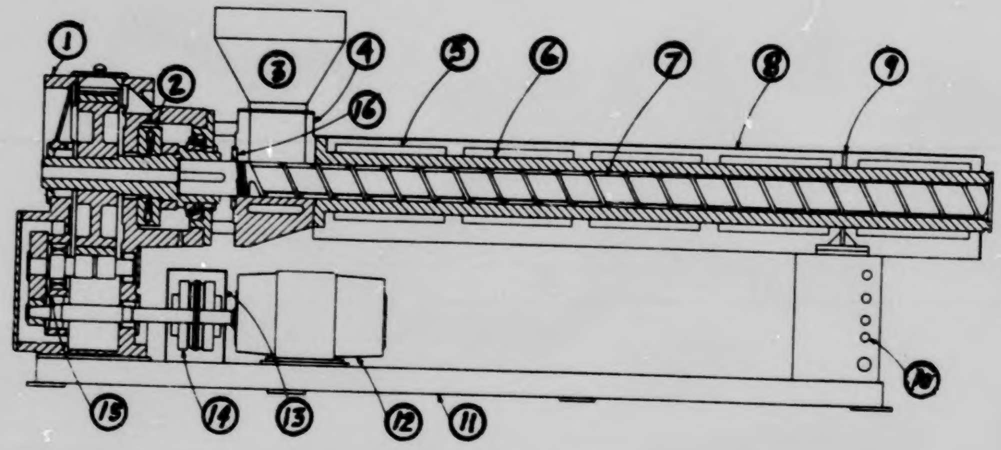
10. Maintain proper extrusion pressure to ensure safe operation of the equipment.

11. Various parts of the machine may need adjustment, or removal, in many cases the parts are heavy so that proper hoisting equipment must be used.

12. When cleaning the machine always make sure the main switch to the machine is thrown.

13. Keep close inspection of all gauges on the machine.

EXTRUDER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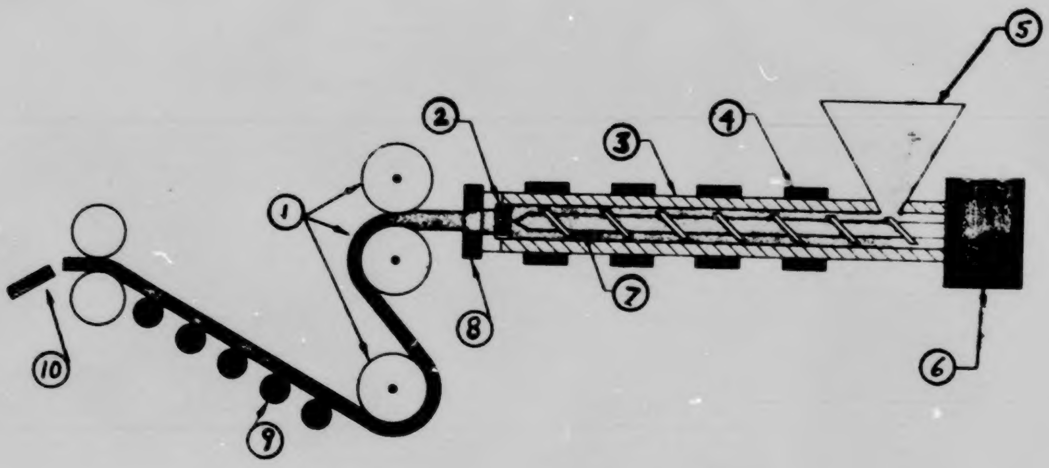
1 Reducer
2 Thrust bearing assembly
3 Hopper
4 Throat
5 Heaters with cooling coils
6 Barrel
7 Screw
8 Barrel guard

9 Barrel support
10 Receptacles
11 Base
12 Motor
13 Coupling guard
14 Coupling
15 Change gears

EXTRUDER



1 Water cooled chromed rollers

2 Screen

3 Barrel

4 Heaters

5 Feed hopper

6 Drive motor

7 Screw

8 Die

9 Supporting rollers

10 Shear

EXTRUDER SAFETY QUIZ

NAME ____________________

CLASS ____________________

DATE ____________ GRADE ______

(Circle true or false)

1. The purging of a machine doesn't call for any extra safety precautions above the normal operation of the equipment. T F

2. The extruded part will be very hot as it comes from the machine. T F

3. There is no need for eye protection. T F

4. There is no need for hand protection. T F

5. While purging the machine others may watch. T F

6. The floor must be dry and clean. T F

7. Proper air pressure must be maintained on the machine. T F

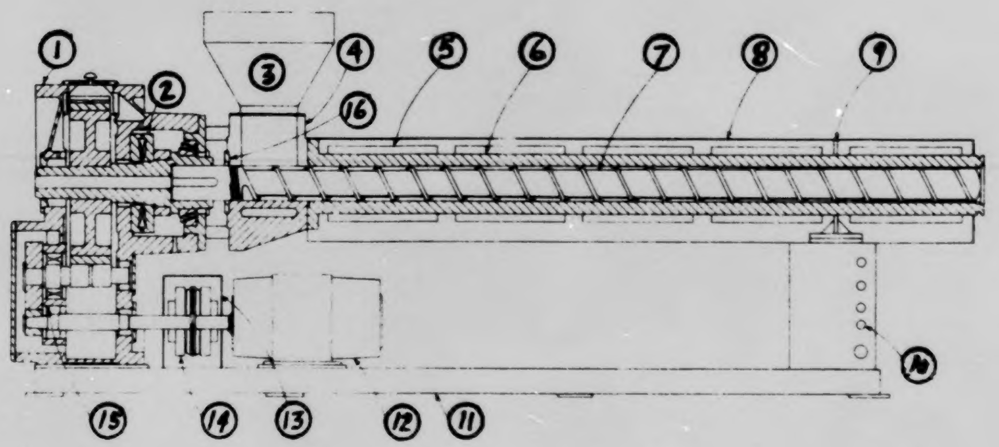
8. Do not attempt to clean or disassemble the machine until the electrical circuits are inactivated. T F

Complete the following question:

9. Be sure all ____________ are in place before operating the extruder.

10. In the spaces provided, identify the parts of the extrusion machines.

A.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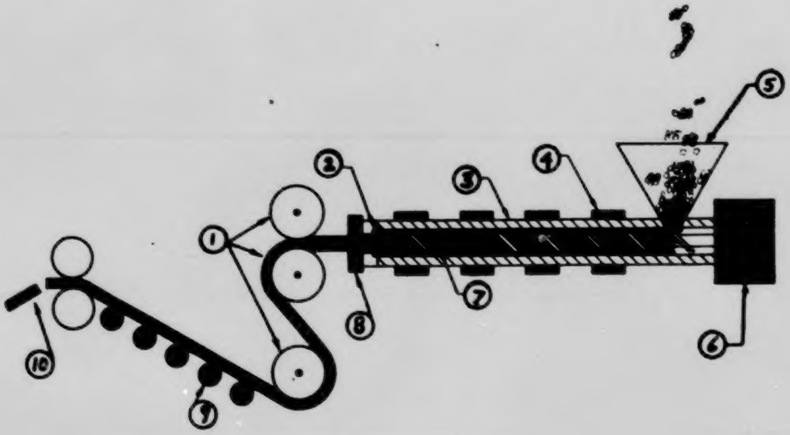
15 ______________________________

Extrusion machine (cont'd)

B.



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10 ______________________

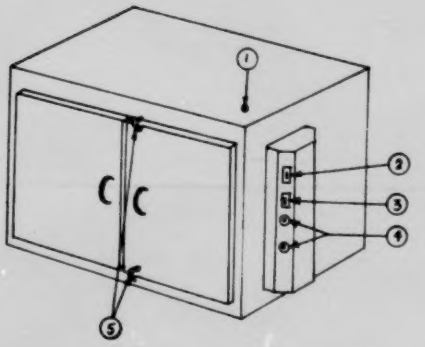
Signed ______________________
Pupil

____
Date

____
Teacher

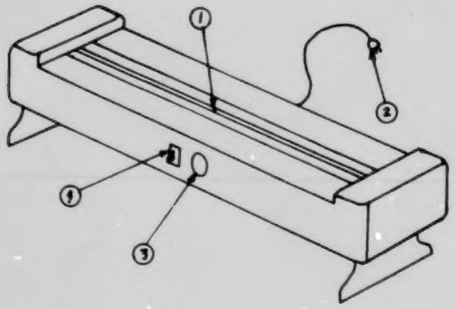
HEATING OVENS, GUNS, STRIP HEATER

HEATING OVEN



1. VENT HOLE
2. FAN SWITCH
3. HEATER SWITCH
4. TEMPERATURE CONTROLS
5. SPRING DOOR

STRIP HEATER



1. HEATING ELEMENT
2. PLUG
3. CONTROL LIGHT
4. SWITCH

1. Wear proper heat resistive gloves and clothing when working around the heating devices used to form plastics.

2. Maintain proper heating ranges when using plastics heating units because uncontrolled heat can cause the plastics to burn and become a fire hazard.

3. Wear safety glasses in the laboratory.

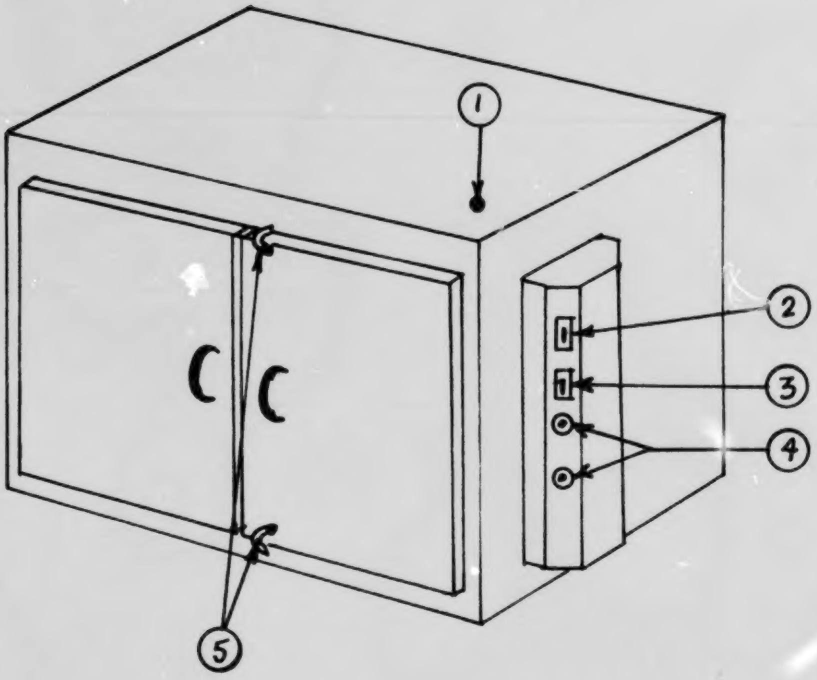
4. Use caution with the electrical parts of the appliance. Don't operate the units if wet or in a damp area.

5. Take precautions with the appliance when operation is completed because the unit will remain hot and hazardous to other persons in the laboratory.

6. Check for clearance from the teacher before using a heating unit.

7. Exercise extreme care when operating a strip heater because the heating element is exposed.

HEATING OVEN



1 Vent hole

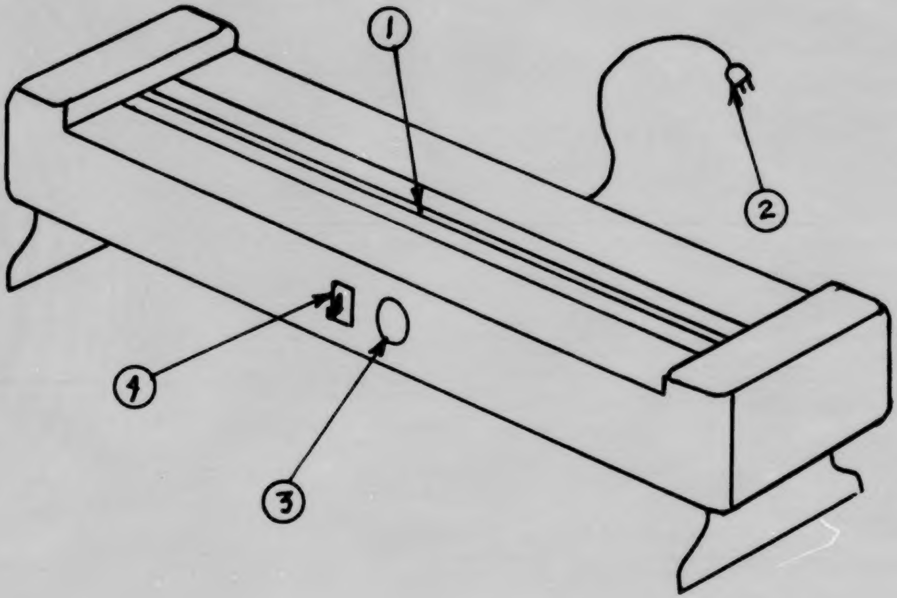
2 Fan switch

3 Heater switch

4 Temperature controls

5. Spring door catch

STRIP HEATER



1 Heating element	3 Control light
2 Plug	4 Switch

HEATING UNIT SAFETY QUIZ

NAME ______________________

CLASS ______________________

DATE ____________ GRADE_____

(Circle true or false)

1. The danger in the heating device is the possible burn to the persons in the laboratory if they make contact with the hot unit. T F

2. Some units will heat plastics up to their flash points. T F

3. Safety glasses do not need to be worn. T F

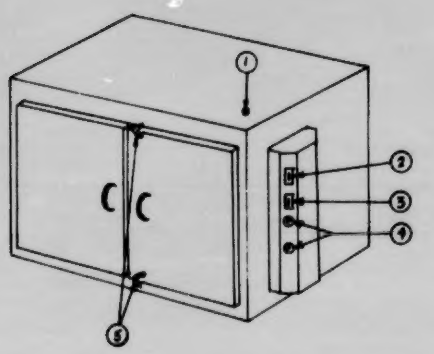
4. The heating element of the strip heater is easily touched. T F

Complete the following question:

5. ____________ with the plastics material during the heating operation can burn the operator.

6. In the spaces provided, identify the parts of the heating units.

A. HEATING OVEN



1 ______________________

2 ______________________

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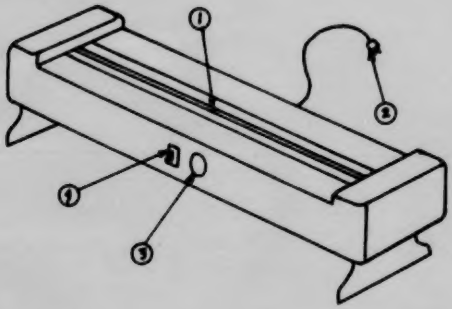
4 ______________________

5 ______________________

6. Parts of heating units cont'd

B. STRIP HEATER



1 ____________________ 3 ____________________

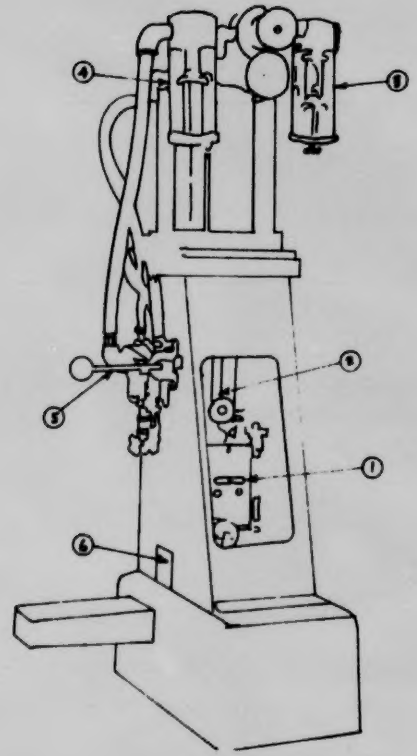
2 ____________________ 4 ____________________

Signed ____________________
Pupil

____
Teacher

____
Date

INJECTION MOLDER



1. HEATING CHAMBER
2. RAM
3. OIL CHAMBER
4. AIR CHAMBER
5. RAM OPERATING HANDLE
6. MOLD VISE

Injection molding machines vary greatly according to size of the "shot" injected into the mold cavity and the actual physical size of the machine. While their functions are basically the same, their safety rules differ, even though many rules are common.

The safety rules below are in reference to a small machine used in schools and industries where a small "shot" size is needed and a high rate of production is not necessary.

1. Wear proper eye protective devices.
2. Control the heat because overheated plastics will be forced out of the molds.
3. Obtain permission from the teacher to operate the injection molder.
4. Control the ram pressure and mold clamping pressure in a range for safe operation of the molder.
5. Remember that the molded plastics will stay very hot for a period of time when out in the air.
6. Beware of the electricals in case of damp conditions.
7. Wear proper hand protection when moving the hot molds or the parts.
8. Caution bystanders when purging injection molding equipment.

9. Keep all guards in place while operating the molder.

10. Remember that air operated machines are much quicker in movement than the hydraulic machines and may cause a safety hazard.

11. Be sure the machine is up to the proper heat for the plastics material before operating the ram into the barrel.

12. Keep your fingers out of the feed hopper.

13. Be careful where you touch the machine; parts of the machine are extremely hot.

14. Work in a ventilated area because heated plastics expel fumes.

In addition to the rules listed previously, the following rules must also be observed when using the large, commercial injection molders.

1. Do not remove any safety shield or device from the machine except for maintenance or mold change; replace all devices before commencing operation.

2. Do not attempt to defeat safety devices by any means.

3. Do not allow more than one operator to operate machine at the same time.

4. Treat all molding machines with respect as even machines with very small clamp capacities can cause painful injury when carelessly operated.

5. Shut off pump motor and turn machine mode selector switch to "manual" when working in clamp area for other than ordinary part removal or loading of inserts in the mold.

6. Check all safety devices periodically; such checks must be made at the beginning of each shift of operation or whenever changes in operation have been made.

7. Do not stand on bed of press when operating for any reason.

8. When purging machine, always stand back and away from the nozzle. WARNING: The existence of the second nozzle requires that extra caution be observed.

9. Always shut off pump when working in die area to mount molds, connect water lines, etc.

10. Wear asbestos gloves when handling heated barrel, nozzles, or when working with heated mold.

11. Do not attempt to clear frozen material from nozzle by pressure alone. Allow nozzle heater to melt the plug or heat nozzle tip with torch. Nozzle slug will ooze out when properly heated. If the nozzle does not pass the material using the above methods, remove the nozzle and check the orifice for blockage by foreign material.

12. Do not adjust limit switches, etc., when machine is operating.

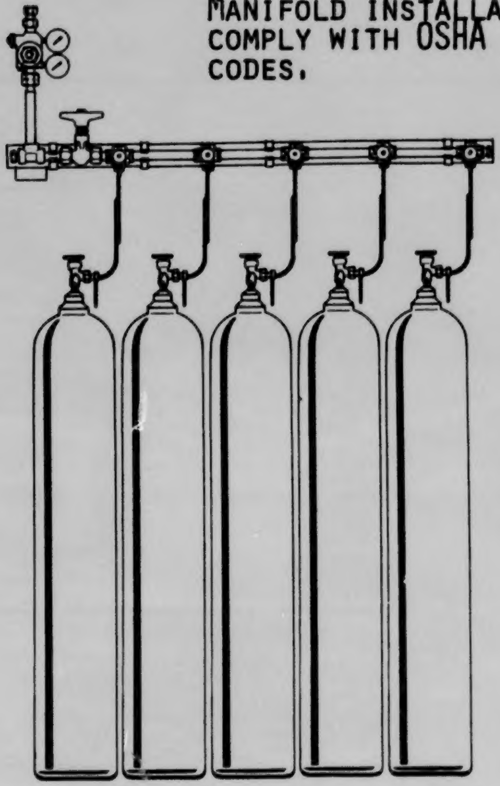
13. Be sure that all mold mounting bolts are tight. Retighten these and all machine bolts and nuts periodically.

14. Heavy molds should only be handled with a properly sized hoist and eye-bolts.

15. Do not reach up into parts chute.

16. With the two-color rotating die, observe these precautions: For mechanical rotation, do not use excessive clamp speeds as this may cause damage to the indexing system; For hydraulic and mechanical rotation, be sure all hydraulic lines and electrical wires are clear of mold.

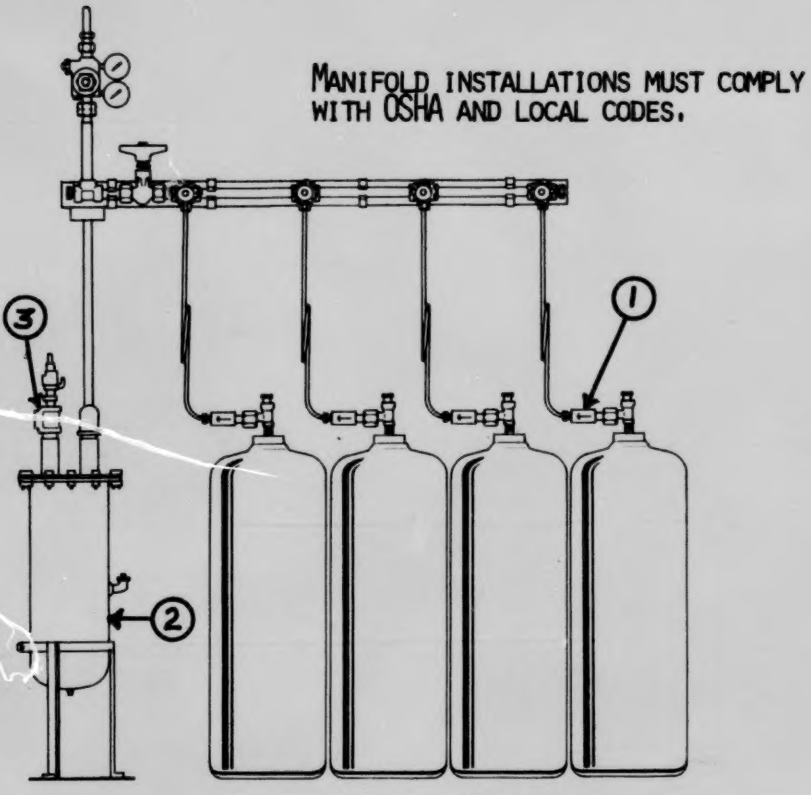
MANIFOLD WITH MANUAL CONTROLS



MANIFOLD INSTALLATIONS MUST COMPLY WITH OSHA AND LOCAL CODES.

A COMPLETE SINGLE HEADER (NO RESERVE) MANIFOLD SYSTEM WITH WALL MOUNTED CONTROL. CYLINDERS LOCATED RIGHT OF CONTROL SECTION. PROVIDED WITH SHUT-OFF VALVES FOR EACH PIGTAIL CONNECTION. INDIVIDUAL PIGTAIL CHECKS. A TWO-STAGE REGULATOR IS PROVIDED THAT WILL MAINTAIN A CONSTANT SUPPLY OF UP TO 175 PSI REGARDLESS OF DECREASING CYLINDER PRESSURE.

MANIFOLD WITH MANUAL CONTROLS FOR ACETYLENE SERVICE


MANIFOLD INSTALLATIONS MUST COMPLY WITH OSHA AND LOCAL CODES.
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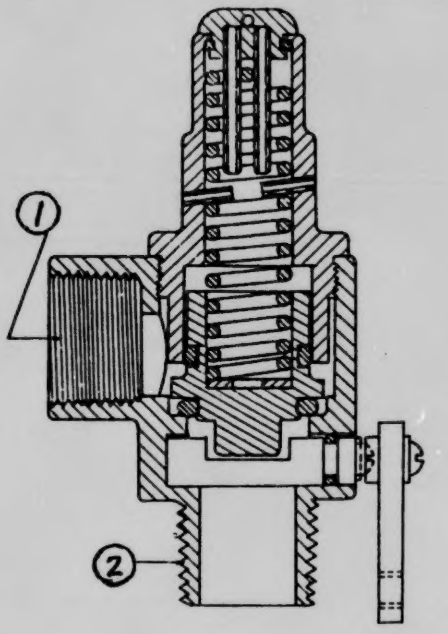
A COMPLETE SINGLE HEADER (NO RESERVE) MANIFOLD SYSTEM WITH WALL MOUNTED CONTROL. CYLINDERS LOCATED RIGHT OF CONTROL SECTION. PROVIDED WITH SHUT-OFF VALVES FOR EACH PIGTAIL CONNECTION. A TWO-STAGE REGULATOR IS PROVIDED THAT WILL MAINTAIN A CONSTANT SUPPLY OF UP TO 15 PSI REGARDLESS OF DECREASING CYLINDER PRESSURE. EQUIPPED WITH WATER SEAL FLASH ARRESTOR WITH INDIVIDUAL PIGTAIL FLASH ARRESTORS AND BACK CHECK VALVES.

1 SAFETY REVERSE FLOW CHECK VALVE (BACK FLOW CHECK VALVE)

2 FLASH ARRESTOR

3 SAFETY RELIEF VALVE

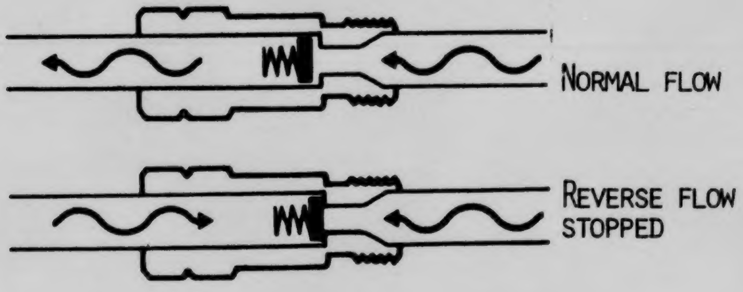
SAFETY RELIEF VALVE



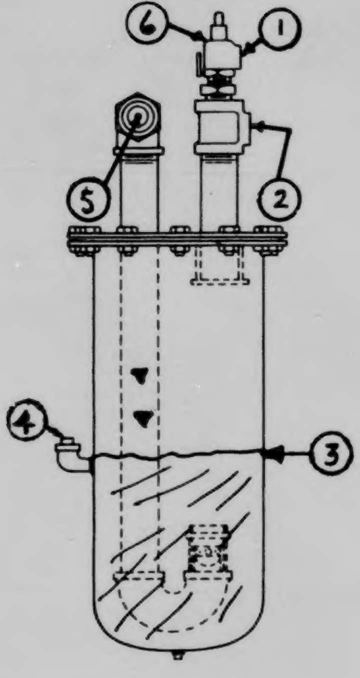
1. Inlet
2. Outlet

THIS VALVE IS USED ON WATER SEAL FLASH ARRESTORS TO PREVENT EXCESSIVE PRESSURES FROM DEVELOPING IN AN ACETYLENE OR OTHER FUEL GAS SUPPLY SYSTEM. PRESSURE IS SET IN THE FIELD TO RELIEVE AT 17 TO 22 PSIG. INSTRUCTIONS ARE FURNISHED WITH EACH UNIT.

SAFETY REVERSE FLOW CHECK VALVE


NORMAL FLOW
REVERSE FLOW STOPPED

FLASH ARRESTOR

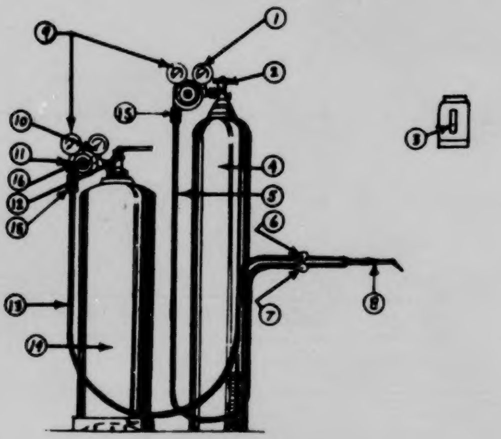


1. VENT OPENING
2. OUTLET
3. WATER
4. PLUG
5. INLET
6. SAFETY RELIEF VALVE

WATER SEAL FLASH ARRESTOR IS INTENDED FOR USE ON ACETYLENE MANIFOLDS AND STATION DROPS TO PREVENT ANY IGNITION FROM PASSING BACK INTO THE MAIN FUEL SUPPLY LINE.

ACETYLENE GAS PASSES THROUGH THE WATER BATH THEN RISES VERTICALLY INTO THE OUTLET PIPE. IN THE EVENT OF AN IGNITION FLASHBACK, THE FLASH OR FLAME IS SNUFFED OUT COMPLETELY BY THE SURFACE OF THE WATER.

OXY-ACETYLENE WELDER



1. CYLINDER PRESSURE GAUGE
2. OXYGEN CYLINDER VALVE
3. CYLINDER CAP
4. OXYGEN CYLINDER
5. OXYGEN HOSE
6. ACETYLENE TORCH VALVE
7. OXYGEN TORCH VALVE
8. WELDING BLOWPIPE
9. OUTLET PRESSURE GAUGE
10. CYLINDER PRESSURE GAUGE
11. ACETYLENE REGULATOR
12. ACETYLENE CYLINDER VALVE
13. ACETYLENE HOSE
14. ACETYLENE CYLINDER
15. SAFETY REVERSE FLOW CHECK VALVE
16. ADJUSTING SCREW

1. Obtain permission from the teacher to use the oxy-acetylene welder.

2. Wear safety goggles at all times when gas welding.

3. Adjust the welder for operation in the following sequence:

   A. Inspect the regulator's adjusting screws to ensure that they are all the way out (counterclockwise).

   B. Open the oxygen cylinder (green) valve slowly. (When wide open, stand to one side.)

   C Open the acetylene cylinder (red) valve (1/4 to 1/2 turn).

   D. Open the torch oxygen valve one turn.
      (1) Turn the oxygen regulator valve adjusting screw until the proper reading is obtained. (See the chart for tip being used.)

      (2) Turn off the torch oxygen valve.

   E. Turn the acetylene regulator adjusting screw in slowly until the correct reading is obtained for the tip being used.

4. Have the teacher check setup before lighting the torch.

5. Use the following procedure for lighting the torch:

A. Turn the torch acetylene valve 1/16 of a turn, then ignite the acetylene gas coming from the tip with a spark lighter.

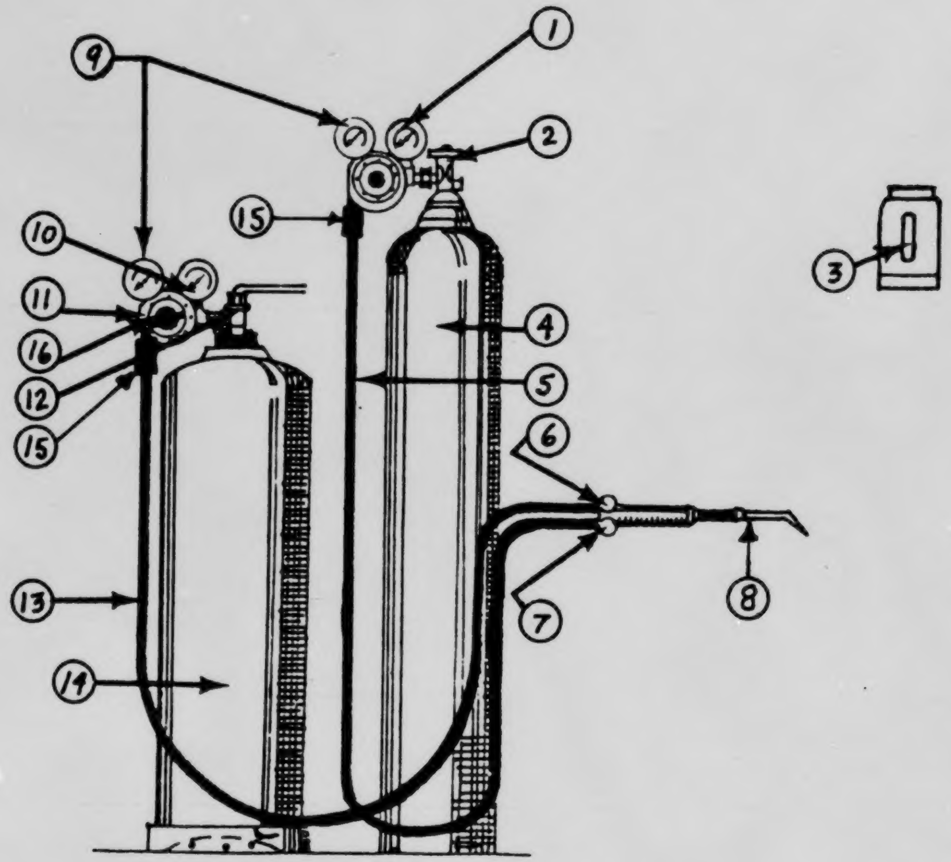
B. Readjust the acetylene regulator adjusting screw until the correct reading is obtained.

C. Turn the acetylene torch valve on slowly until the flame jumps away from the tip. Then slightly reduce the fuel supply to bring the flame back to the tip.

D. Adjust the torch oxygen valve to obtain a neutral flame.

6. NEVER lay down a lighted torch.
7. NEVER use acetylene gas at a pressure greater than 15 lbs. psi.
8. Take care not to burn the hoses.
9. Replace goggles, hoses, and torch in their proper places and clean the area when welding is finished.

OXY-ACETYLENE WELDER



1 Cylinder pressure gauge
2 Oxygen cylinder valve
3 Cylinder cap
4 Oxygen cylinder
5 Oxygen hose
6 Acetylene torch valve
7 Oxygen torch valve
8 Welding blowpipe
9 Outlet pressure gauge
10 Cylinder pressure gauge
11 Acetylene regulator
12 Acetylene cylinder valve
13 Acetylene hose
14 Acetylene cylinder
15 Safety reverse flow check valve
16 Adjusting screw

OXY-ACETYLENE WELDER SAFETY QUIZ

NAME ____________________________________

CLASS ____________________________________

DATE __________________ GRADE __________

True-False: Circle the answer that is correct.

T F 1. Gas bottles may be laid on the floor when not in use.

T F 2. Closed containers are not hazardous to weld or repair.

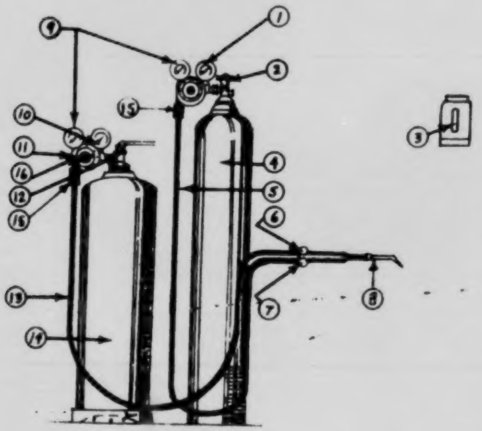
T F 3. The cylinder caps should be placed on all bottles when not in use.

T F 4. Eye protection must be worn for all welding, cutting, and chipping operations.

T F 5. The equipment should not be wiped down with oily rags.

T F 6. Acetylene pressure should be set at 20 psi.

In the spaces provided, identify the parts of the oxy-acetylene welder:



1 ______________________________
2 ______________________________
3 ______________________________
4 ______________________________
5 ______________________________
6 ______________________________
7 ______________________________
8 ______________________________
9 ______________________________
10 ______________________________
11 ______________________________
12 ______________________________
13 ______________________________
14 ______________________________
15 ______________________________
16 ______________________________

Signed ______________________
Pupil

______________________ Date ______________________
Teacher

OXYGEN-ACETYLENE WELDING SAFETY QUIZ

NAME ______________________

CLASS ______________________

DATE __________ GRADE ______

True-False:

T F 1. Oxygen and acetylene hoses may be interchanged.

T F 2. A hose may be repaired with tape when damaged.

T F 3. A regulator should always be attached before using oxygen from a cylinder.

Multiple Choice: Put the correct letter on the line preceding the number.

______ 4. Oil or grease in the presence of oxygen pressure may cause:

A. ignition.
B. low pressure.
C. flameout.

______ 5. Acetylene regulators and acetylene cylinder valve outlets have __________ thread connections.

A. right-handed
B. left-handed
C. vertical

______ 6. The blowpipe oxygen valve should be __________ when testing connections for leaks.

A. open
B. closed
C. removed

______ 7. Leaks in a blowpipe hose can be tested by immersing it in ________________.

A. oil
B. water
C. soapy water

521

_______ 8. The acetylene tank valve should be opened:

A. all the way.
B. one half turn.
C. one and one half turns.
D. two and one half turns.

_______ 9. The acetylene hose is always colored:

A. blue.
B. green.
C. red.
D. none of these.

_______ 10. The oxygen hose is always colored:

A. blue.
B. green.
C. red.
D. none of these.

_______ 11. One should make sure welding equipment is:

A. lubricated with oil.
B. tightened by hand.
C. kept free of oil and grease.
D. lubricated weekly.

_______ 12. Welding goggles are worn because they:

A. magnify the work.
B. protect the eyes from dust.
C. help a person concentrate on his/her work.
D. protect the eyes against heat, rays, and sparks.

_______ 13. The valve on a cylinder of acetylene should be opened:

A. with a pair of pliers.
B. three full turns.
C. one and one fourth turns or less.
D. as many turns as possible.

_______ 14. When lighting a welding torch, one should use:

A. a friction torch lighter.
B. a match.
C. a fluid lighter.
D. a piece of lighted paper.

______15. If a welding torch backfires, one should:

A. dip the torch in water.
B. Inspect the hose.
C. put an "Out-of-order" sign on the equipment.
D. close the acetylene valve first.

______16. One should move cylinders by:

A. tilting and rolling them on their bottom edge.
B. dragging or sliding them.
C. lifting them with the valve protection caps.
D. dropping them.

______17. When storing cylinders, they should be:

A. kept away from heat and extreme weather changes.
B. stored in a small, well-ventilated, dry location.
C. kept away from highly combustible materials.
D. all of the above.

______18. One should close valves:

A. before moving.
B. on empty cylinders.
C. when work is finished.
D. in all of the above.

______19. Acetylene hose pressure should be limited to below:

A. 20 lbs. per square inch.
B. 18 lbs. per square inch.
C. 15 lbs. per square inch.
D. 25 lbs. per square inch.

______ 20. If a hose is damaged, one should:

A. continue to use it.
B. replace it.
C. bind it with tape.
D. do none of the above.

Complete the following questions:

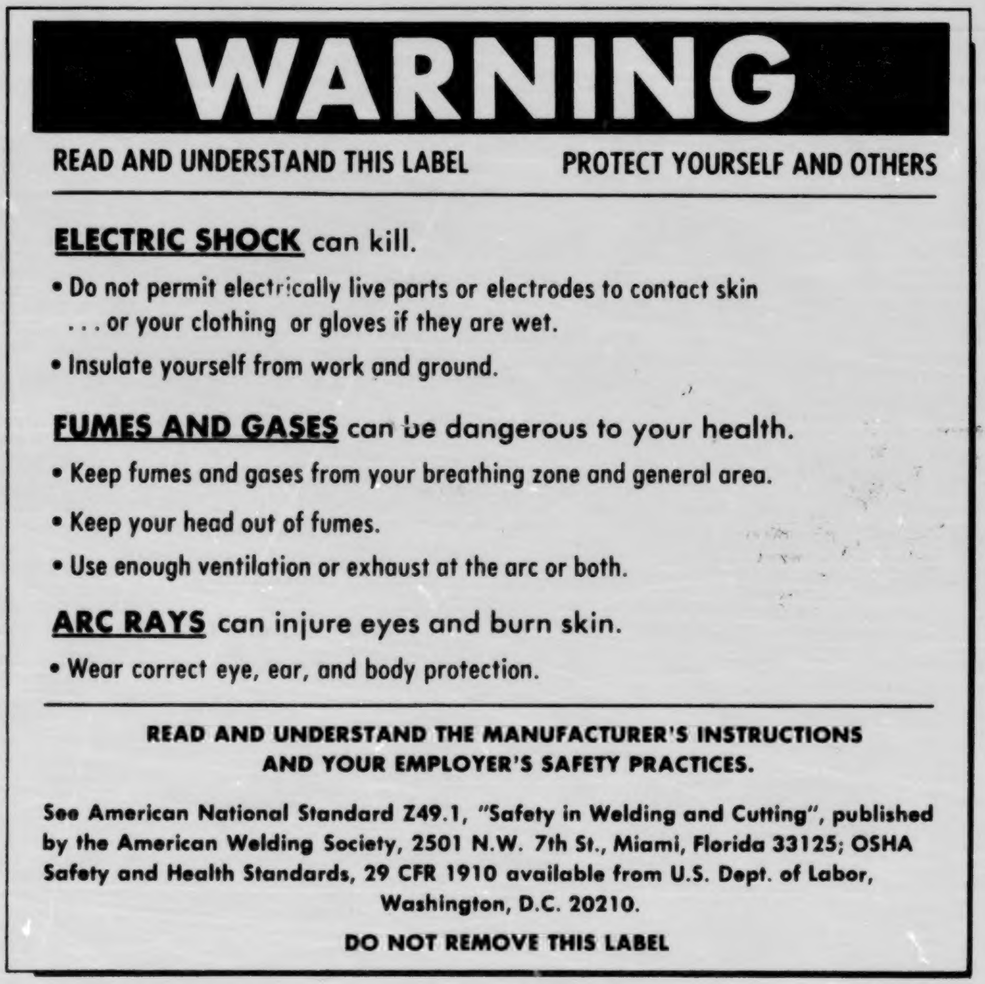
21. Before moving a cylinder, one should close the valve and replace ______________________________.

22. One should immediately report any leaking of cylinders or connections to the ______________________________.

23. The acetylene pressure in the hose should be kept below ____________________ pounds per square inch.

24. Anyone watching a welding flame must wear welding ____________

In response to the arc welding industry's ongoing concern for safety and the health of welders, the American Welding Society has established a new standard for warnings. Over the next several months, welders will start seeing a new warning on Lincoln electrode and flux packages. Following shortly will be a similar warning on power sources and wire feeders. An example of this new warning is reproduced below:



WARNING

READ AND UNDERSTAND THIS LABEL **PROTECT YOURSELF AND OTHERS**

ELECTRIC SHOCK can kill.

- Do not permit electrically live parts or electrodes to contact skin . . . or your clothing or gloves if they are wet.
- Insulate yourself from work and ground.

FUMES AND GASES can be dangerous to your health.

- Keep fumes and gases from your breathing zone and general area.
- Keep your head out of fumes.
- Use enough ventilation or exhaust at the arc or both.

ARC RAYS can injure eyes and burn skin.

- Wear correct eye, ear, and body protection.

READ AND UNDERSTAND THE MANUFACTURER'S INSTRUCTIONS AND YOUR EMPLOYER'S SAFETY PRACTICES.

See American National Standard Z49.1, "Safety in Welding and Cutting", published by the American Welding Society, 2501 N.W. 7th St., Miami, Florida 33125; OSHA Safety and Health Standards, 29 CFR 1910 available from U.S. Dept. of Labor, Washington, D.C. 20210.

DO NOT REMOVE THIS LABEL

ARC WELDING SAFETY PRECAUTIONS

PROTECT YOURSELF AND OTHERS FROM POSSIBLE SERIOUS INJURY OR DEATH. READ AND UNDERSTAND BOTH THE SPECIFIC INFORMATION GIVEN IN THE OPERATING MANUAL FOR THE WELDER AND/OR OTHER EQUIPMENT TO BE USED AS WELL AS THE FOLLOWING GENERAL INFORMATION.

1. Have all installation, maintenance and repair work performed only by qualified people.
2. Protect yourself from possible dangerous electrical shock:
   a. The electrode and work (or ground) circuits are electrically "hot" when the welder is on. Never permit contact between "hot" parts of the circuits and bare skin or wet clothing. Wear dry, hole-free gloves to insulate hands.
   b. Always insulate yourself from the work and ground using dry insulation when welding in damp locations, on metal floors, gratings or scaffolds, and particularly when in positions (such as sitting or lying) where large areas of your body can be in contact with a conductive surface.
   c. Maintain the electrode holder, work clamp, welding cable and welding machine in good, safe operating condition.
   d. Never dip the electrode holder in water for cooling.
   e. Never simultaneously touch electrically "hot" parts of electrode holders connected to two welders because voltage between the two can be the total of the open circuit voltage of both welders.
   f. If using the welder as a power source for mechanized welding, the above precautions also apply for the automatic electrode, electrode reel, welding head, nozzle or semiautomatic welding gun.
3. Keep all equipment safety guards, covers and devices in position and good repair.
4. Keep hands, hair, clothing and tools away from V-belts, gears, fans and all other moving parts when starting, operating or repairing equipment.
5. When working above floor level, protect yourself from a fall should you get a shock. Never wrap the electrode cable around any part of your body.
6. Arcburn may be more severe than sunburn. Therefore:
   a. Use a shield with the proper filter and cover plates to protect your eyes from sparks and the rays of the arc when welding or observing open arc welding. Filter lens should conform to ANSI Z87.1 standards.
   b. Use suitable clothing to protect your skin and that of your helpers from the arc rays.
   c. Protect other nearby personnel with suitable non-flammable screening and/or warn them not to watch the arc nor expose themselves to the arc rays or to hot spatter or metal.
7. Droplets of molten slag and metal are thrown or fall from the welding arc. Protect yourself with oil free protective garments such as leather gloves, heavy shirt, cuffless trousers, high shoes and a cap over your hair. Wear ear plugs when welding out of position or in confined places.
8. Always wear safety glasses when in a welding area. Use glasses with side shields when near slag chipping operations.
9. Remove fire hazards well away from the area. If this is not possible cover them to prevent the welding sparks from starting a fire. Remember that welding sparks and hot materials from welding can easily go through small cracks and openings to adjacent areas.
10. When not welding, make certain no part of the electrode circuit is touching the work or ground. Accidental contact can cause overheating and create a fire hazard.
11. Be sure the work cable is connected to the work as close to the welding area as practical. Work cables connected to the building framework or other locations some distance from the welding area increase the possibility of the welding current passing through lifting chains, crane cables or other alternate circuits. This can create fire hazards or overheat lifting chains or cables until they fail.
12. Welding may produce fumes and gases hazardous to health. Avoid breathing these fumes and gases. When welding, keep your head out of the fume. Use enough ventilation and/or exhaust at the arc to keep fumes and gases away from the breathing zone. When welding on galvanized, lead or cadmium plated steel and other metals which produce toxic fumes, even greater care must be taken.
13. Do not weld in locations near chlorinated hydrocarbon vapors coming from degreasing, cleaning or spraying operations. The heat and rays of the arc can react with solvent vapors to form phosgene, a highly toxic gas, and other irritating products.
14. Do not heat, cut or weld tanks, drums or containers until the proper steps have been taken to insure that such procedures will not cause flammable or toxic vapors from substances inside. They can cause an explosion even though they have been "cleaned." For information purchase "Safe Practices for Welding and Cutting Containers That Have Held Combustibles", A6.0-65 from the American Welding Society, Miami, Florida 33125.
15. Vent hollow castings or containers before heating, cutting or welding. They may explode.
16. For more detailed safety information it is strongly recommended that you purchase a copy of "Safety in Welding & Cutting — ANSI Standard Z49.1" for $5.00 from the American Welding Society, Miami, Florida 33125.

Additional Safety Precautions

For Electrically Powered Welders

The high voltage and rotating parts associated with this type of equipment require observance of these additional precautions:

1. Disconnect and lock out all power sources before doing any work on the equipment.
2. Make the electical installation in accordance with the National Electrical Code and all local codes.
3. Properly ground the equipment in accordance with the National Electrical Code and the manufacturer's recommendations. The work or metal to be welded must also be connected to a good electrical ground.

For Engine Powered Welders

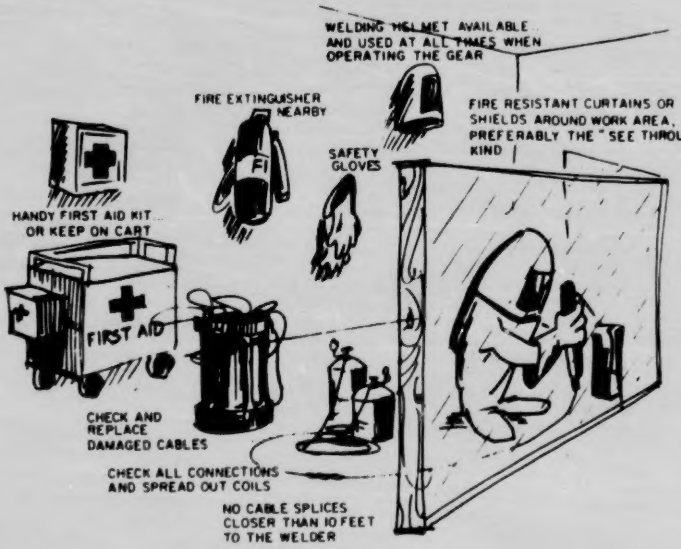
The required fuel and rotating parts associated with this type of equipment require observance of these additional precautions

1. Whenever possible, turn the engine off before troubleshooting and maintenance work.
2. Operate internal combustion engines in open, well-ventilated areas or vent the engine exhaust fumes to the outside.
3. Do not add the fuel near an open flame or when the engine is running. Stop the engine and, if possible, allow it to cool to prevent spilled fuel from igniting on contact with hot engine parts or electrical sparks. Do not spill fuel when filling tank.
4. To prevent accidentally starting gasoline engines while turning the engine or welding generator during maintenance work, disconnect the spark plug wires, distributor cap or magneto wire as appropriate.
5. To avoid scalding, do not remove the radiator pressure cap when the engine is hot.

(AMERICAN WELDING SOCIETY)

ELECTRIC WELDING SAFETY

(OSHA/NIOSH)


WELDING HELMET AVAILABLE .. AND USED AT ALL TIMES WHEN OPERATING THE GEAR
FIRE EXTINGUISHER NEARBY
FIRE RESISTANT CURTAINS OR SHIELDS AROUND WORK AREA, PREFERABLY THE "SEE THROUGH" KIND
SAFETY GLOVES
FI
HANDY FIRST AID KIT... OR KEEP ON CART
FIRST AID
CHECK AND REPLACE DAMAGED CABLES
CHECK ALL CONNECTIONS AND SPREAD OUT COILS
NO CABLE SPLICES CLOSER THAN 10 FEET TO THE WELDER

1. Welding machine trouble shall always be checked by competent authorized electricians. NEVER BY A PUPIL.

2. Polarity switches shall not be operated while the machine is working under load. These switches are to be operated only while the machine is idling.

3. The frame or case of the welding machine (excluding engine-driven machines) is required to be grounded.

4. Do not ground to pipelines carrying gases of flammable liquids or conduits carrying electrical conductors.

5. If the floors have been wetted down, special precautions must be taken against electrical shock.

6. Do not ground to a building structure remote from the weld.

7. A disconnecting switch or controller is required at or near each arc welding machine which is not equipped with such a switch or controller mounted as an integral part of the welder.

8. Cables with splices within ten feet of the holder are prohibited.

9. Work and electrode lead cables with damaged insulation or bare conductors require replacement.

10. Check electrode holders for loose or exposed connections to reduce the shock hazard.

11. Check for leaks in gas hoses, if metal inert gas welding process is used.

12. Do not coil or loop electrode cable around parts of your body.

13. Noncombustible booths or screens are required to protect the workers or other persons adjacent to welding areas from welding rays unless the workers are required to wear appropriate goggles.

14. Portable welding equipment that is suspended from overhead structures is required to be equipped with safety chains or cables capable of supporting the total shock load in the event of support failure.

15. Store electrode holders where they cannot make electrical contact with personnel, conducting objects, fuels, or compressed gas tanks.

16. When no welding is to be done for any substantial period of time (e.g., for lunch or overnight), all electrodes must be removed from holders and the machine disconnected from the power source.

17. Never strike an arc on a compressed gas cylinder. Keep electrodes, electrode holders, and any other live parts away from gas cylinders.

18. The electrode holder shall be placed on a hook when not in use. Do not leave it on the floor.

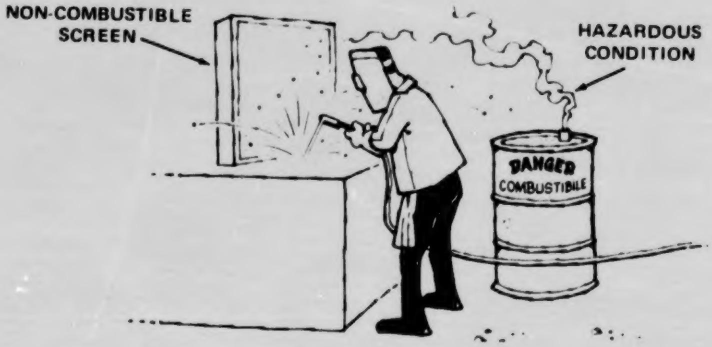
19. A portable flash shield shall be used when working in an open area to protect other personnel from arc flash.

20. Pliers (not gloves) must be used to carry hot projects.

21. Welding cables shall be kept dry and free from grease and oil.

22. All welding operations shall be performed within the rated capacity of the welding cables.

23. All flammable and combustible materials must be removed from the welding area.



24. One must not work in an area where combustible dust is suspended in the air.

25. No welding or cutting should be performed on used drums, barrels, tanks, or other containers until they have been cleaned thoroughly, eliminating all flammable materials and all substances (such as greases, tars, or acids) which might produce flammable or toxic vapors when heated.

26. All hollow spaces, cavities, or containers should be vented to permit the escape of air or gases before preheating, cutting, or welding.

27. Do not weld on or cut pipes or other metals in contact with combustible walls, partitions, ceilings, or roofs, if the work is close enough to start a fire by conducting heat through the metal.

28. If the process being used requires open circuit (no load) voltages higher than the voltages indicated in the following table, adequate insulations must be provided to prevent shock.

	Operation	
Type	Manual	Automatic (mechanized)
Alternating current	80 volts	100 volts
Direct current	100 volts	100 volts

29. For a.c. welding under wet conditions or where perspiration is a problem, a reliable automatic control should be used to reduce the the no-load voltage. This will prevent shock.

30. Do not change the polarity switch when the machine is under load. The arcing due to the high current can burn the switch contact surface or cause serious burns to the welder.

31. Check to see that the welding machine has a power disconnect switch. This allows immediate shutdown in case of emergency. A machine should not be used unless it has such a switch.

ELECTRIC WELDING SAFETY QUIZ

NAME______________________________

CLASS______________________________

DATE_______________ GRADE___________

(Circle true or false)

1. One should avoid looking at the arc or flash unless equipped with the appropriate dark glasses. T F

2. Helmets and welding goggles must be free of cracks or holes. T F

3. It is not necessary to wear protective clothing when arc welding. T F

4. It is safer and better to wear low-cut shoes, rather than boots, in any welding situation. T F

Multiple Choice:

_____ 1. Rotary current-setting switches may be changed:

A. when the machine is under full load.
B. when the machine is idling.
C. at any time.

_____ 2. Polarity switches may be changed:

A. at any time.
B. when the machine is under full load.
C. when the machine is idling.

_____ 3. Welding machine trouble shall be checked by:

A. the pupil.
B. an authorized electrician.
C. anyone.

_____ 4. Gasoline tanks will be welded in school shops:

A. always.
B. never.
C. sometimes.

_____ 5. An electric arc flash will burn:

A. the skin and eyes.
B. the feet.
C. the clothing.
D. all of the above.

_____ 6. The ground clamp should be attached firmly to:

A. the welder.
B. the work.
C. the table.
D. both B and C.

_____ 7. Arc ray burns should be treated as:

A. heat rash.
B. a minor sunburn.
C. a scald.
D. a severe sunburn.

_____ 8. The cables need to be:

A. kept insulated.
B. kept dry.
C. free from grease and oil.
D. all of the above.

_____ 9. Report to the teacher at once:

A. if the electrode holder, ground clamp lugs, or cable gets hot.
B. if the handle slips off the electrode holder.
C. if there is a bare wire.
D. if all of the above occur.

_____ 10. When handling hot metal, use:

A. a helmet.
B. a pair of pliers
C. a c-clamp.
D. a chipping hammer.

_____11. The observation window in the welding helmet is cracked. It will:

A. allow dust to pass through it.
B. obstruct one's view.
C. transmit infrared and ultraviolet rays.
D. rattle every time the helmet is flipped up.

_____12. When one has finished using the electrode holder, one should:

A. place it on a metal workbench.
B. clamp it on the metal frame of the workbench.
C. rest it on the floor.
D. suspend it so that it will not touch any metal.

_____13. If a cable or the electrode holder overheats, one should:

A. notify the teacher.
B. turn the voltage down.
C. stop welding and wait until it cools.
D. change the electrode holder.

_____14. One should always draw the curtains on the welding booth before striking an arc in order to:

A. protect the eyes from the infrared and ultraviolet rays.
B. keep the work from getting cool.
C. prevent anyone from noticing any mistakes.
D. protect anyone nearby from the infrared and ultraviolet rays.

_____15. Before leaving heated metal unattended, one should use chalk or soapstone to label it with the word "hot" because:

A. someone may be burned if he/she touches it.
B. other work may be placed on it.
C. One can then tell to whom it belongs.
D. chalk will help cool it.

Electric Welding Safety Quiz(continued)

Complete the following statements:

16. For eye protection against infrared and ultraviolet rays, a person must wear a welding____________________.

17. When chipping slag, one must wear____________________.

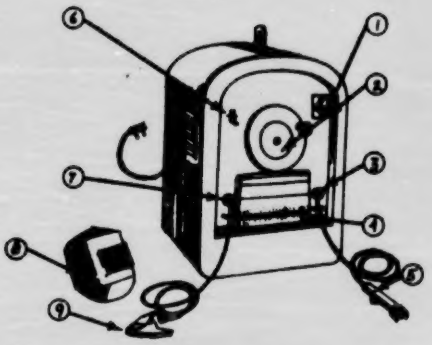
18. Arc welding should be done only behind proper screens or in a ____________________.

19. If one's skin is exposed to electric arc rays, he/she will be ____________________.

20. A____________________should be near when electric welding is being done.

21. The welding area should be well____________________.

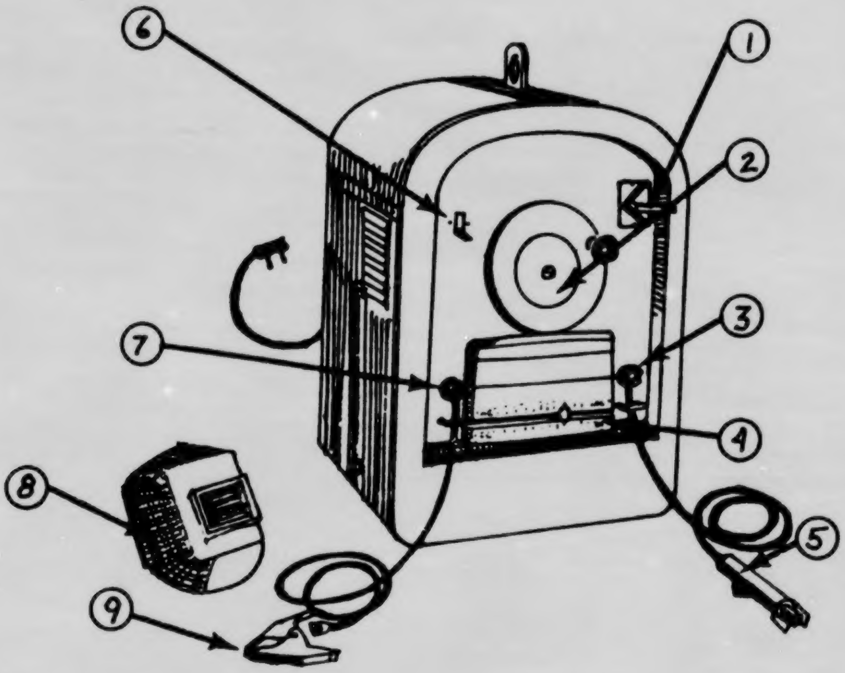
ARC WELDER



1. AC-DC SWITCH
2. AMPERAGE ADJUSTMENT
3. ELECTRODE CABLE CONNECTION
4. AMPERAGE INDICATOR
5. ELECTRODE HOLDER
6. ON-OFF SWITCH
7. GROUND CABLE CONNECTION
8. HELMET
9. GROUND CLAMP

1. The arc welder must be operated only with the teacher's permission and after instruction has been received.
2. Jewelry must be removed, loose clothing eliminated, and long hair confined.
3. All guards are to be in place and operating correctly.
4. The proper eye protection must always be used.
5. A welding helmet must be worn when welding.
6. Proper ventilation must be available.
7. Goggles must be worn when chipping slag.
8. Others in the area must be warned prior to striking an arc.
9. Gloves and proper clothing must be worn when welding.
10. Closed containers should not be welded without the teacher's permission.
11. Cables, clamps, and electrode holder should be checked and working properly.
12. Screens to protect others must be in place before welding is started.

ARC WELDER



1 AC-DC switch
2 Amperage adjustment
3 Electrode cable connection
4 Amperage indicator
5 Electrode holder
6 On-off switch
7 Ground cable connection
8 Helmet
9 Ground clamp

ARC WELDER SAFETY QUIZ

NAME ______________________

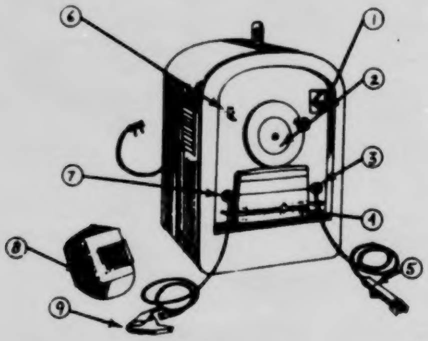
CLASS ______________________

DATE __________ GRADE _______

(Circle true or false)

1. A person should warn anyone nearby before starting to weld. T F
2. Goggles, as well as a welding hood, should be available before starting to weld. T F
3. A closed container is dangerous to weld. T F
4. Gloves are not necessary when welding. T F
5. It is dangerous to weld without the proper ventilation. T F
6. An electric shock is possible if both the electrode and ground are contacted. T F

7. In the spaces provided, identify the parts of the arc welder.



1. ______________________________

2. ______________________________

3. ______________________________

4. ______________________________

5. ______________________________

6. ______________________________

7. ______________________________

8. ______________________________

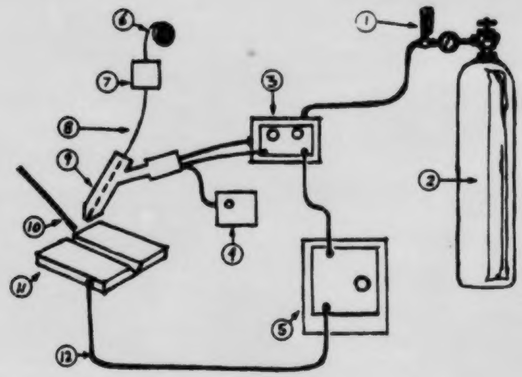
9. ______________________________

Signed ______________________________
Pupil

____
Teacher

____
Date

TIG (TUNGSTEN INERT GAS) WELDER
MIG (METAL INERT GAS) WELDER



1. FLOW METER & REGULATOR
2. INERT GAS SUPPLY
3. CONTROL SYSTEM
4. COOLANT SYSTEM
5. WELDING MACHINE
6. WIRE REEL
7. WIRE FEEDER(MIG)
8. WIRE
9. TORCH
10. ELECTRODE (TIG)
11. WORK
12. GROUND

1. Operate only with the teacher's permission and after instruction has been received.

2. Remove jewelry, eliminate loose clothing, and confine long hair.

3. Make sure all guards are in place and operating correctly.

4. Always use the proper eye protection.

5. Always buff using the lower half of the buffing wheel.

6. Wear additional protective welding clothing, including a helmet, longsleeved jacket, and gloves in order to prevent burns from ultraviolet and infrared rays emitted while arc welding.

7. Use a helmet for TIG or MIG welding that is equipped with a minimum number twelve density shade.

8. Be certain that the welder equipped with a high frequency stabilizing unit is installed, maintained, and used according to the recommendations of both the manufacturer and the Federal Communication Commission.

9. Never touch the tungsten electrode or MIG wire while the welder is turned on. It is electrically "hot" and can cause a serious shock.

10. Never us the high frequency when performing shield metal arc (stick electrode) welding.

TIG (Tungsten Inert Gas) Welding

1. Wear heavy, fire-resistant clothing, including longsleeved shirts and leather gloves.

2. Use a safety shield to protect the people in surrounding areas from eye damage.

3. Use pliers or a suitable tool for handling the hot metal.

4. Use the proper shade of glass in the welding hood to protect the operator from ultraviolet rays that damage the eyes.

5. Keep the area clear of inflammable liquids and foreign inflammable material and objects.

MIG (Metal Inert Gas) Welding

1. Check and use the proper equipment, such as gauges, hoses, and electrical cables.

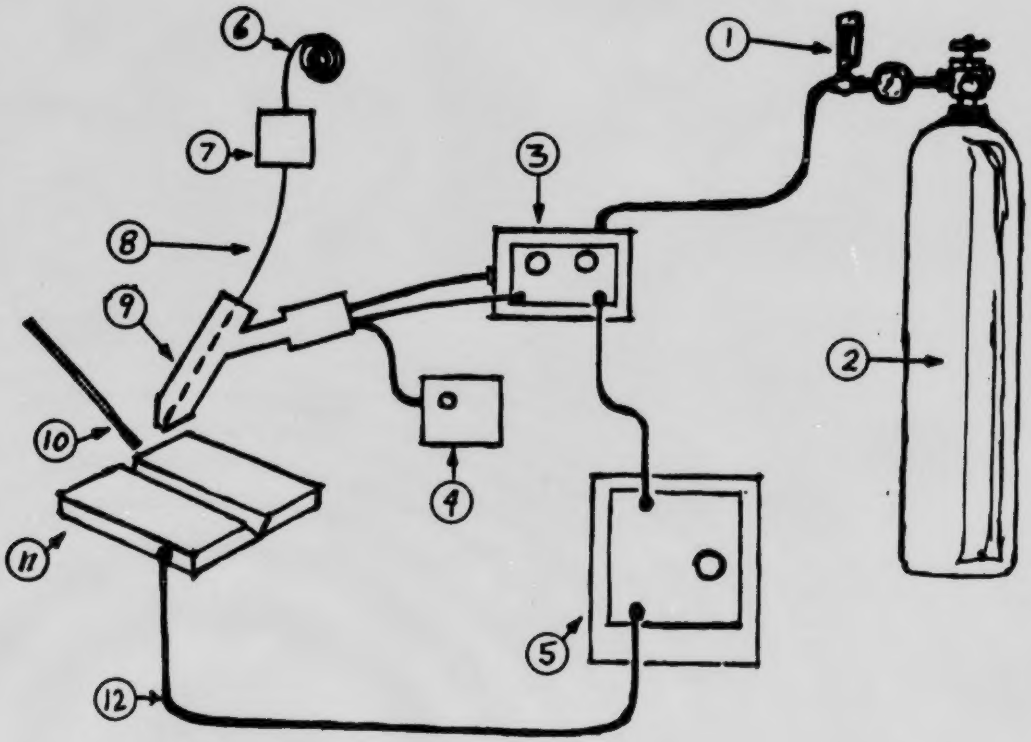
2. Use the proper shielding to protect all bystanders.

3. Weld near proper ventilation to exhaust fumes and inert gases.

4. Wear the proper welding helmets and lenses.

5. Wear proper personal clothing, such as gloves, leather jackets, and hair protectors.

TIG (TUNGSTEN INERT GAS) WELDER
MIG (METAL INERT GAS) WELDER



1 FLOW METER & REGULATOR

2 INERT GAS SUPPLY

3 CONTROL SYSTEM

4 COOLANT SYSTEM

5 WELDING MACHINE

6 WIRE REEL

7 WIRE FEEDER (MIG)

8 WIRE

9 TORCH

10 ELECTRODE (TIG)

11 WORK

12 GROUND

TIG & MIG WELDER SAFETY QUIZ

NAME____________________________________

CLASS____________________________________

DATE________________ GRADE________________

(Circle true of false)

1. High frequency welding units are manufactured according to guidelines established by the Federal Communications Commission. T F

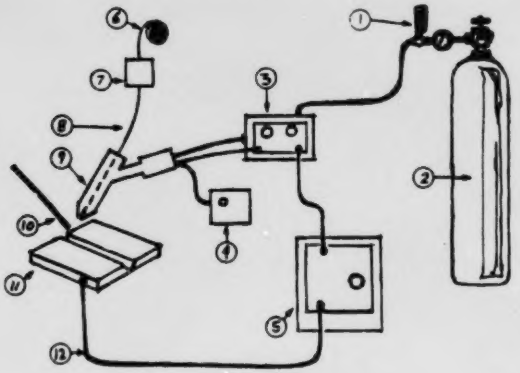
2. It is all right to do TIG or MIG welding without a welding helmet. T F

3. A worker can be shocked by touching the tungsten electrode while the TIG welder is turned on. T F

4. The high frequency switch must be turned off while performing regular arc welding. T F

5. Both metal arc welding and gas-shielded arc welding give off ultraviolet and infrared radiation which can burn the unprotected skin. T F

6. Name the parts in the following illustration.



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Signed____________________________
Pupil

____
Teacher

Date____________________

SPOT WELDERS

Spot welding is a method of joining two pieces of metal together with electric heat and mechanical pressure. The heat is developed by the resistance of the metal to high-amperage, low-voltage current which passes through a limited area. This is where a resistance weld is made. Some safety suggestions for operating the spot welder follow:

1. Before attempting to make power line connections, change tips, or make repairs, be sure the unit is completely disconnected from the power line.

2. Always avoid contact between any part of the human body and any current-carrying part of the spot welder.

3. Be sure the welder is connected to the proper voltage and securely grounded. A grounding wire is provided in the power cord for grounding the welder in case of internal insulation breakdown. Do not cut off the grounding terminal on the cord plug.

4. Operate the spot welder from a separately-fused circuit. The capacity of the welder is affected by the line voltage. If the circuit is overloaded, the performance will be reduced. Extension cords should not be used because of the voltage drop they are apt to cause.

5. Wear a face shield when operating a spot welding machine. This protects the eyes and face from hot molten particles.

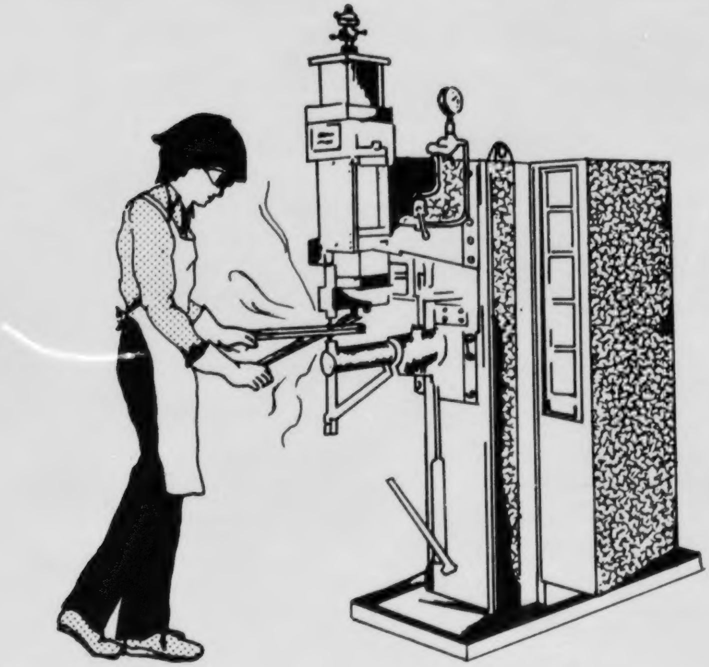
6. Be sure the tongs are properly aligned and the pressure correctly adjusted before turning on the welder. Check the alignment before the power is turned on. If the tips are misaligned, the work to be welded will move out of place. There is no advantage in having excessive tong pressure. The metal to be welded should be in close contact before applying pressure on the tongs.

7. Never apply current to the tong tips without having metal between them.

8. Keep the tong tips dressed. As the welder is used, the diameter of the tong tips will increase in size. This increased diameter will require more current and a longer time setting. For galvanized and stainless steels, the tips must be clean and properly dressed or the weld will cause excessive splatter.

9. Be sure there is water flowing through water-cooled welders before using them. If water is not flowing to cool the tips, they will be burned.

10. Start the exhaust fan before welding galvanized metal. The fumes given off from welding zinc-coated material may cause zinc fume fever.



SPOT WELDING CAN RELEASE SMALL QUANTITIES OF FUMES.

SOLDERING AND BRAZING OPERATION

The health hazard potential of any soldering or brazing operation depends on, among other things, the types of filler metals, fluxes, coatings, cleaning agents, gases, and base metals used. It is important, therefore, that a person should know what materials he/she is working with and what hazards/symptoms they present. It is also important that if one begins to experience any of these symptoms, he/she report to the school nurse or seek prompt medical advice. The following discussion talks about some of the materials and exposure symptoms that might be encountered.

CLEANING AGENTS

ACIDS--For the most part, acids used for cleaning should be diluted with water. (IF ONE MUST DO ONE'S OWN DILUTING, THE FOLLOWING "RULE OF THUMB" APPLIES: ALWAYS PUT THE ACID INTO THE WATER; NEVER PUT THE WATER INTO THE ACID. ALSO, A FULL FACE SHIELD AND PROTECTIVE GLOVES SHOULD BE WORN.) However, even diluted acids can cause skin burns and can generate irritating fumes. Therefore, work with any acids should be carried out in well-ventilated areas and face shield and protective gloves should be worn. Some specific acids that might be encountered include:

1. HYDROCHLORIC OR MURIATIC ACID--A corrosive acid, yellowish in color. Inhalation of hydrochloric acid fumes will cause a choking sensation.

2. SULFURIC ACID--This acid is intensely irritating to the respiratory system and skin. When used to remove rust, scale, and oxide from metals, it can form hydrogen, a flammable gas.

3. PHOSPHORIC ACIDS--Although not as hazardous as sulfuric acid, exposure to phosphoric acid can result in an inflammation of the mucous membranes and also skin irritation.

4. NITRIC ACIDS--This acid can cause severe skin burns and severe irritation of the respiratory tract.

ALKALIS--Alkali mixtures used in cleaning operations usually contain sodium or potassium hydroxide. When sodium or potassium hydroxide is put into water to make a solution, it can cause the water, depending on the amount added, to boil. This causes bubbling and splashing, so that concentrated solutions or bits of the solid alkalis can get on the skin or in the eyes of the person mixing the solution. Inhalation of the fumes can irritate the tissues and membranes of the respirator tract. Skin contact with these alkalis will cause irritation.

ORGANIC SOLVENTS--Organic solvents are used to remove oils and grease from the workpiece. Most organic solvents are flammable and thus are potential fire and explosion hazards. Exposure to the vapors of organic solvents can result in irritation of the eyes, nose, throat, and lungs; dizziness; headaches; and sensations of drunkenness. Organic solvents containing chlorine may break down due to the heat and generate phosgene gas which, at low concentration (less than one part per million), has a sweet odor. At about one ppm it smells like musty or new-mown hay. Phosgene is a severe pulmonary irritant and, in high concentrations, can cause death. Prolonged or continued skin contact with most organic solvents will remove essential skin oils which will lead to dry, cracking skin and possibly irritation and/or infection.

ULTRASONIC CLEANING--Passing an ultrasonic soundwave through a solution creates a vibratory force which breaks off particles and contaminants from small metal parts that were placed in the solution for cleaning. If one uses ultrasound cleaning methods, he/she should follow the manufacturer's instructions and check with the teacher or supervisor for any special protective clothing required.

SOLDERING FLUXES

Many fluxing agents are used in soldering and brazing operations. The fluxing agent is determined by the metals to be joined. In most cases, these fluxes give off acid or alkali fumes when heated. Because they contain acids and/or alkalis, they can irritate the skin. Again, conducting soldering and brazing operations in well-ventilated areas (see the section on ventilation) and the use of protective clothing and gloves are recommended.

CORROSIVE FLUXES--These fluxes leave a chemically active residue after soldering.

1. **ZINC CHLORIDE**--This is the main ingredient in corrosive fluxes used in the soldering of stainless steel, galvanized iron, cast iron, and aluminum. Zinc chloride fumes can irritate the eyes, nose, and lung tissue, and skin contact with this fluxing agent can cause chemical burns.

2. **AMMONIUM CHLORIDE**--The inhalation of these fumes will be irritating to respiratory passages.

3. **STANNOUS CHLORIDE**--It is not considered a serious health hazard. The fumes are irritating to respiratory passages.

4. **ACIDS**--They are frequently used as ingredients with fluxes. (See the discussion under "Cleaning Agents.")

INTERMEDIATE FLUXES--Lastic, benzoic, and glutamic acids frequently are used in the mild intermediate fluxes. These organic acids can produce a mild irritation of the skin upon contact. The fumes can be mildly irritating to respiratory passages.

NONCORROSIVE FLUXES--Rosin dissolved in an organic solvent is the most common type of noncorrosive flux. Typical solvents are alcohol, turpentine, or petroleum spirits--all of which are flammable. Exposure to these solvents can result in an irritation of the respiratory passages and can cause some central nervous system effects (see "Organic Solvents"). Rosin dissolved in trichloroethylene --which is nonflammable-- is also used. If trichloroethylene is the solvent, special attention must be given to providing adequare ventilation when soldering with this type of flux, due to its potential for generation of phosgene. Fumes generated from the decomposition of these fluxes are irritating to respiratory passages.

BRAZING FLUXES AND ATMOSPHERES

Depending on the type of brazing and base metals used, either a flux or a controlled atmosphere may be used to promote the formation of a brazed joint. The most hazardous brazing fluxes are the fluoborates, fluorides, potassium, and sodium hydroxide.

FLUOBORATES--When heated, the fluoborate can release fluorine fumes which are a severe lung irritant. Overexposure to these fumes is usually minimized, however, due to operator reaction to the sharp odor.

FLUORIDES--These compounds are used in brazing with silver, magnesium, and aluminum-silicon filler metals. The fluoride fumes generated are severe lung irritants. Skin contact with fluoride compounds will cause irritation.

SODIUM AND POTASSIUM HYDROXIDE--This is a fluxing ingredient used on molybdenum alloy steels. (See preview discussion on alkalis)

CONTROLLED BRAZING ATMOSPHERES, commonly employed in furnace brazing, are used to prevent the formation of oxides during brazing. Typical brazing atmospheres used are hydrogen, carbon monoxide, carbon dioxide, dissociated ammonia, and nitrogen. To prevent a safety hazard, the work should be done in a physical enclosure or by using local exhaust ventilation. When this is done properly, they present little or no problem of toxicity. However, some mixtures of gases may be explosive. Therefore, before heating the furnace, the atmosphere must be purged with the gas to remove all air.

BASE AND FILLER METALS

A variety of different metals and alloys will be encountered during the soldering and brazing process. The four metals considered the most hazardous are: lead, cadmium, beryllium, and zinc.

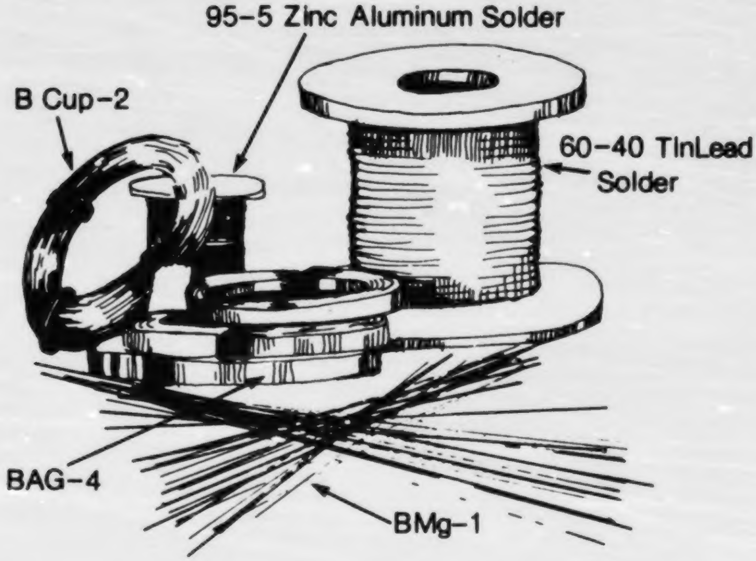
LEAD--Lead is used in the soldering process in the form of lead-tin and lead-silver filler metals. When heated, lead oxide fumes are formed. Excessive exposure to lead oxide fumes can result in lead poisoning. The symptoms include loss of appetite, indigestion, nausea, vomiting, constipation, headache, abdominal cramps, nervousness, and insomnia.

CADMIUM--Cadmium is found in some silver and zinc solders and in some base metals. When heated, cadmium oxide fumes can be generated. Excessive exposure to these fumes can result in cadmium poisoning. The symptoms include dry cough, irritation of the throat and nasal passages, tightness of the chest, and restlessness. Cadmium has been suspected of causing cancer of the prostate.

BERYLLIUM--Beryllium is used in magnesium filler metals for furnace brazing, and in some aluminum brazing filler metals. While soldering, temperatures are normally too low to generate fumes from beryllium, but the heat involved in brazing can generate beryllium fumes, which are extremely hazardous. Short term exposure to these fumes may result in a chemical pneumonia. Long term effects include shortness of breath and chronic cough, loss of weight, and fatigue. NIOSH has considered beryllium to be a potential human lung carcinogen.

ZINC--Zinc is used in large amounts in zinc-cadmium and zinc-aluminum solders, and in some base metals. When heated, zinc oxide fumes are generated. Excessive exposure to freshly formed zinc oxide fumes can give one an illness called metal fume fever or "zinc chills." Symptoms include the presence of a sweetish or metallic taste in the mouth, dryness and irritation of the throat, coughing, a feeling of weakness, fatique, and a general malaise condition similar to that of influenza. Usually the illness disappears in a day or so with no permanent after-effects. The presence of zinc oxide dust, which is the end product several minutes after zinc oxide fume formation, presents little or no health problems.

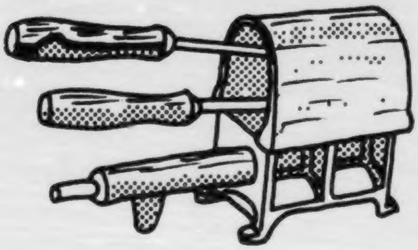
OTHER METALS--Other trace metals present in base and filler metals which give off toxic fumes include antimony, arsenic, chromium, bismuth, cobalt, nickel, selenium, thorium, vanadium, or compounds of these metals. NIOSH has stated that arsenic is a suspected lung and lymphatic carcinogen; chromium (hexavalent) is a suspected lung carcinogen. The amount of fumes generated from these trace metals is usually small, and hazardous concentrations are not normally found. But soldering and brazing with filler or base metals containing these trace elements should be conducted in well-ventilated areas to be absolutely sure that hazardous concentrations do not exist.



TYPICAL SOLDERING AND BRAZING FILLER METALS

SOLDERING IRONS

The traditional soldering tool is the soldering iron with a copper bit. This bit is usually heated electrically or with a gas flame. This gas flame can be used in a heating stove, or it can be used to internally heat the bit.



FLAME HEATED IRON

One of the most common hazards associated with using soldering irons is burns. One should make sure that the soldering iron is equipped with a properly insulated holder before using it. When not in use, the soldering iron should be placed in a fireproof holder (or back in the stove) and never allowed to lie on the floor, chairs, or tables where it can come in contact with combustible materials or accidentally be touched by any person. A hot soldering iron should never be left unattended. If it is electric, make sure it is disconnected.

FLAME HEATED IRONS

1. Check the hose connections, particularly the stove connection, for gas leaks. Also, check the connections at the cylinder valve if a "bottled" fuel gas is used. (Soap and water may be used.)
2. Remember that gas-fired irons are not thermostatically controlled, so care must be taken to prevent overheating of the metals which could result in the generation of excess fumes.

ELECTRICALLY HEATED IRONS

Before using an electrically-heated iron, one should make the following safety checks.

1. Check the thermostatic control (if the soldering iron has one) to make sure that it is working properly, and that it is adjusted to the proper temerature.

2. Check the lead cord for proper insulation and make sure that it is free from grease and oil. Also, make sure that the cord is not lying in walkways where it could present a tripping hazard.

3. Check all electric tools and extension cords. They should be fitted with a three-prong plug for proper grounding.

4. Store all electric soldering irons in a dry place. Check the iron before using it to be sure it's dry.

SLANTS ON SAFETY

REGO COMPANY 4201 W. PETERSON AVE. CHICAGO, ILL.

"REGO SLANTS ON SAFETY"
(DIALOGUE FOR TRANSPARENCY PRESENTATION)

POLICE YOUR WORK AREA

1. Never place welding or cutting operations close to combustible materials. (gasoline cans, paints, paper, rags, etc.)

2. Cylinders with regulators attached should not be rolled to a new location. Regulators should be removed and protective cylinder valve caps installed before moving.

   The exception is when cylinders are secured in a welding cart. Even then, the cylinder valves should be closed before the cart is moved.

3. All cylinders (particularly acetylene) in use should be securely retained in an upright position to prevent accidents. A non-vertical position of an acetylene cylinder in use would allow the discharge of acetone through the welding or cutting torch, clogging the mixer passages, creating a fire hazard, reducing the efficiency of the flame, and contaminating the weld area.

STORAGE OF CYLINDER VALVES

1. Cylinders should not be stored near stair wells, gangways, elevator shafts, etc. where cylinders may be knocked over or damaged by passing or falling objects.

2. Store all gas cylinders not in use away from excessive heat sources such as stoves, furnaces, radiators, and the direct rays of the sun or in the presence of open flames. Cylinders in storage should always be securely chained to a wall or support in an upright position.

3. Keep any burning substance or combustible materials away from oxygen supplies and post "No Smoking" signs.

4. When necessary to move gas cylinders, always carefully roll them on their bottom edge, being sure that the protective shipping cap is securely in place.

   Sliding, dragging, or rolling them causes excessive wall wear, which may create hazardous conditions.

5. Do not hammer on, drop, or use gas cylinders as rollers for machinery moving purposes.

6. Never directly use a hammer blow to loosen the protective transportation cap on oxygen or other types of gas cylinders. Use a short piece of clean wood to absorb the hammer blow and prevent sparks and dangerous spalling of the hammer and metal cap.

7. If a leak develops in a fuel gas cylinder that cannot be stopped by closing the valve, immediately place the cylinder outside the building away from a possible fire source (in a location free from a wind current which might carry the gas fumes to an ignition source).

   Post temporary warning signs near a leaking cylinder, notify the gas dealer immediately, get special instructions on how to return the cylinder to the dealer.

8. When a gas cylinder is ready for return to the supplier, be sure the cylinder valve is closed to prevent internal contamination, and the shipping cap is in place to protect the cylinder valve. Mark the cylinder "empty" in a prominent place.

9. Valve protection cylinder caps should never be used for lifting a cylinder. Use a cradle or platform with the cylinders securely chained in place. Do not use slings or electro-magnet lifts.

10. Keep fuel gas cylinders separated from oxygen cylinders in storage. Keep empty cylinders separated from full ones in storage. (NFPA 51)

FIRE PROTECTION

1. Always have a fire extinguisher in good operating condition and readily available when operating welding and cutting equipment.

2. Upon the completion of a welding, heating, or cutting operation, one should immediately (and carefully) inspect the surrounding area for smoldering embers. At least one half hour should be allowed before leaving the area and then only after conducting another inspection. Also, other personnel in the area should be alerted to the danger of latent fire possibilities.

DRESS PROPERLY

Always wear clean, oil-free clothing during welding and cutting operations. Protect the hands with leather welding gloves to avoid burns from radiation and hot molten slag. Low cut shoes, trousers with cuffs, or open pockets in which sparks or molten slag may lodge should not be worn.

USE YOUR TOOLS CORRECTLY

Never use oxygen or other gases as a substitue for compressed air in the operation of air-operated tools, the blowing off of parts, or for ventilation purposes. The only exception to this rule is where oxygen is used to blow out torch passages and talcum powder to dust from welding hoses when setting up new or old, "dusty" equipment.

DON'T TAMPER WITH CYLINDER SAFETY DEVICES

Never tamper with the safety devices on gas cylinders (fuse plugs, safety disc caps, etc.) or permit the torch flame to contact the cylinders.

CRACKING OF CYLINDER VALVES

Before connecting a regulator to a gas cylinder, open the cylinder valve momentarily (this is called "cracking the cylinder valve") to blow out any accumulated particles of dirt, dust, etc. which may have lodged there in transit. Do not stand in front of the valve outlet when operating the cylinder valve.

SECURE REGULATOR TO CYLINDER WITH PROPER WRENCH

Always use a proper fitting wrench to tighten a regulator to a cylinder or station outlet connection. Never tighten by hand, using the regulator as a substitution for a wrench.

OPEN CYLINDER VALVE SLOWLY

1. After attaching a regulator to a gas cylinder, one should be sure the regulator adjusting screw is fully released. It should be backed off in a counterclockwise direction so it swivels freely before the cylinder valve is opened. One should never stand directly in front of a regulator when turning on the cylinder valve.

2. The cylinder valve should always be opened slowly so gas pressure will build up slowly in the regulator (this particularly applies to the oxygen cylinder). A quick opening of the cylinder valve causes a buildup of heat due to the recompression of the gas. When combined with combustible materials, ignition and fire may result.

3. Always use a regulator to reduce the gas cylinder pressure to the operating pressures recommended by the equipment manufacturer.

SAFE USE OF ACETYLENE

1. Never use acetylene in excess of 15 psig pressures. Hazardous conditions can result beyond this point.
2. Acetylene withdrawal from a cylinder should never exceed 1/7 of the cylinder's capacity. For greater acetylene flows, use a stationary or portable manifold.
3. Withdrawal of acetylene in excess of 1/7 of the cylinder's cubic feet gas capacity can contaminate the weld.
4. Always leave the fuel gas cylinder valve wrench in place when the cylinder valve is open, so it can be closed quickly in an emergency. Do not open acetylene cylinder valves more than one turn.

NEVER USE A REGULATOR FOR A GAS OTHER THAN THAT FOR WHICH IT WAS INTENDED

1. Never attempt to adapt and use a fuel gas or inert gas regulator on an oxygen cylinder. A special protective device is furnished in the REGO oxygen regulator to harmlessly dissipate the heat caused by recompression when the cylinder valve is quickly opened. It is not furnished on fuel gas and inert gas regulators.
2. Never use a regulator for gases other than those for which it was recommended by the manufacturer, as the diaphragm and seat materials may not be compatible with other gases.
3. Always refer to the various gases by their proper name. Do not refer to oxygen as "air" or acetylene as "gas."

PROPER OPERATING PRESSURES

Always follow the manufacturer's recommendations in setting up and operating equipment in the selection of tip size, and in fuel and oxygen operating pressures.

BLOWING OUT WELDING HOSE

1. Never blow out oxygen and acetylene, or other fuel gas hoses, in an unventilated room or around an open flame or other ignition sources.
2. Oxygen supports combustion. It can "puff" a tiny spark into a roaring flame. It can even cause oily or greasy rags to burst into flame from spontaneous combustion or cause a serious fire or explosion.

PRE-OPERATION SAFETY CHECK

1. CAUTION! - Before operating the equipment, be sure all the connections are leak-tight. Each time equipment connections are loosened and retightened, one should carefully check each connection for leaks, using clean, oil-free, soapy water. Do not use flame for this purpose.

2. CAUTION! - Before lighting "up," momentarily (and separetely) allow the oxygen and fuel gases to flow through the torch to ensure that "mixed" gases ARE NOT PRESENT in the welding hoses.

3. Never use defective, worn, or leaky equipment. Have it repaired promptly.

4. If equipment is not to be used for a period of time, the cylinder valves should be closed, the hoses and regulators should be purged of fuel and oxygen, the regulator adjusting screws should be placed in a "backed-off" position, and the torch valves should be closed. Before putting the equipment back into service, it is important to make sure the adjusting screws are released.

USE PROPER HOSE LENGTH

1. Use as short a length of welding hose as practical. The longer the hose length, the higher the operating pressures required. This also wastes gas and may be difficult to handle.

2. Using too many hose splicers can cause an excessive loss of pressure to the torch, which may in turn cause a hazardous operating condition.

LIGHTING TORCH TIP

Never use a match to light a welding or cutting torch. Always use a spark lighter. Fingers are easily burned by the igniting gas, if a match is used.

PROPER EYE PROTECTION

1. Always wear goggles (this includes spectators) to protect the eyes from injurious light rays, sparks, and hot molten metal during welding, cutting, and heating operations. Eye protection should comply with established federal specifications and those recommended by the welding distributor.

2. Always protect oneself, other persons present, welding hoses, gas cylinders, and flammable materials in the area from the hot slag and sparks that come from the welding and cutting operation.

PROPER VENTILATION

Never perform welding, cutting, brazing, or heating operations in a poorly ventilated area. Avoid breathing the fumes from these operations at all times, particularly when zinc, cadmium, or lead-coated metals are involved.

KEEP TIPS CLEAN

1. Dirty, plugged, or partially plugged flame ports can cause overheating, excessive popping, and possible flashback.
2. If one or more preheat ports are restricted on cutting tips, the unbalanced flame condition can cause pre-ignition conditions to exist.
3. Due to the distortion of preheat flames, the operator will automatically reduce the gas flow to compensate for the restricted ports, causing the tip to overheat.

HOW TO ELIMINATE EQUIPMENT "SQUEAKS" AND "YOURSELF"

1. Never oil or grease any part of the welding and cutting equipment, nor allow it to come in contact with oil and grease. This includes (but is not limited to) gas cylinders, tools, work bench, regulators, torches, tips, and even the clothes that are worn (such as jackets, gloves, aprons, etc.).

   Oxygen, and oil or grease under the right conditions, can react violently, resulting in explosions, fire, and damage or injury to property and personnel.

2. Do not attempt to repair the regulators or torch. Equipment which is incorrectly repaired can cause leaks and other hazardous conditions. Consult the local REGO welding equipment distributor.
3. All heating, welding, and cutting equipment must be maintained at an "oxygen clean" level. This also includes tools, clothes, gloves, benches, etc. Otherwise, oil and grease will be transmitted by contact from a "dirty" to a "clean" piece of equipment. Eventually it will come to the oxygen regulator.

WORN WELDING HOSE - DO NOT REPAIR! - REPLACE!!!

Never repair a leaking (worn, abraded, etc.) welding hose with tape or any similar method. Always consult the local REGO supplier for advice. Replace the hose immediately, if safe use is questionable.

MAINTAIN BACK-FLOW CHECK VALVES

With the check valve removed from the torch and/or regulator, place the check unit in the reverse flow position on the test hose. Use oil-free compressed air and check the unit for leaks across the seat. The unit should not leak at pressures above the manufactures's back-flow pressure rating.

CAUTION!-- THE NEXT CUT MADE MAY BE YOUR THROAT!

1. Never use a welding, cutting, or heating torch on a pipe or container that has held a flammable liquid. Explosive vapors can gather and linger in closed containers for a long period of time.
2. The seams and inner side walls of a container usually coated with combustible materials which can gasify with applied heat and combust (with a cutting torch flame).

BEWARE OF FLYING CONCRETE CHIPS!

Prevent concrete "explosion" by using a layer of sand and asbestos sheet to catch slag.

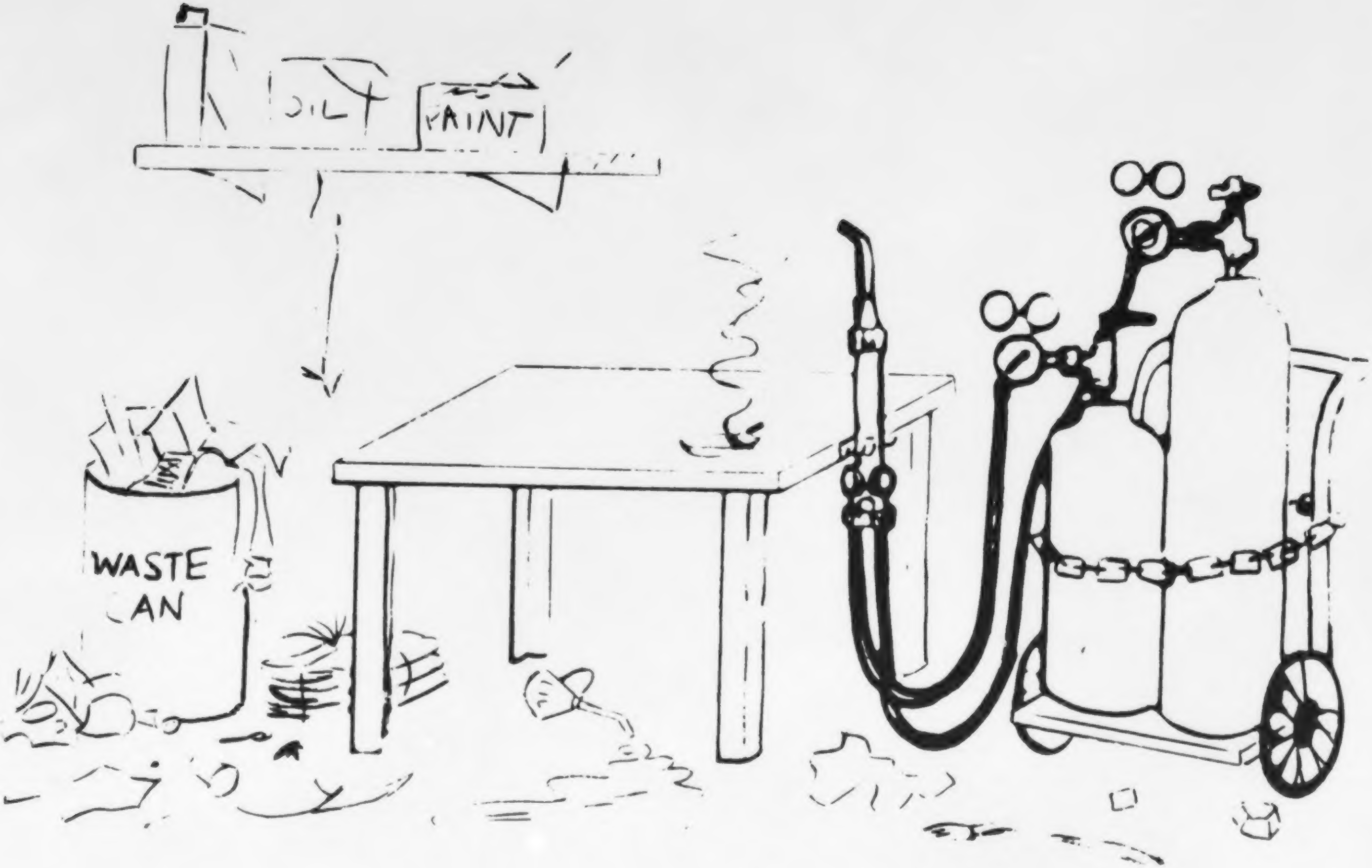
VACATION CAME EARLY THIS YEAR!

Securely support the material that is being cut or welded so it will not fall and cause damage or personal injuries.

LEAVE FILLING OF CYLINDER TO THE MANUFACTURER

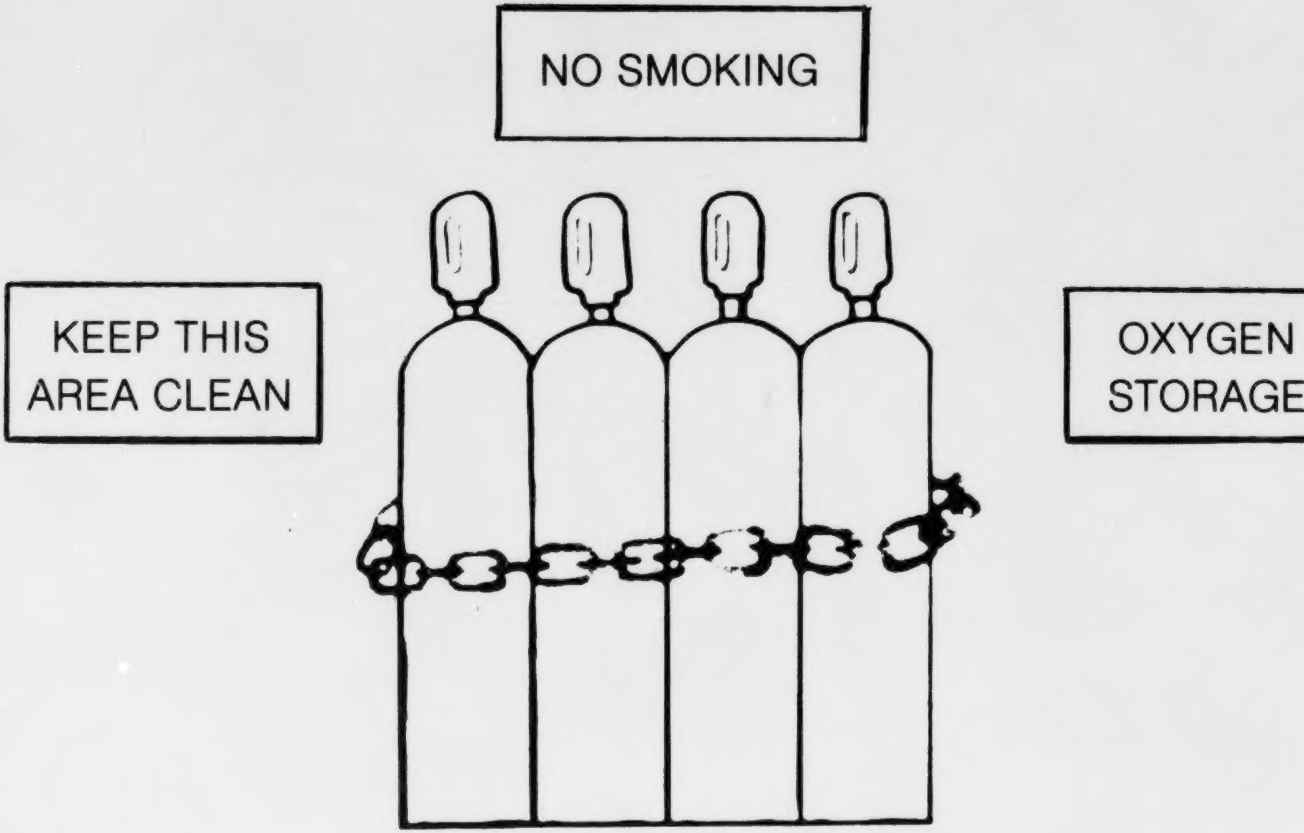
Never attempt to mix gases in a cylinder or fill one empty gas cylinder from another (particularly an oxygen cylinder). The mixture of imcompatible gases and/or heat caused by recompression of the gas or gases may result in ignition and fire.

1149


OIL
PAINT
WASTE CAN

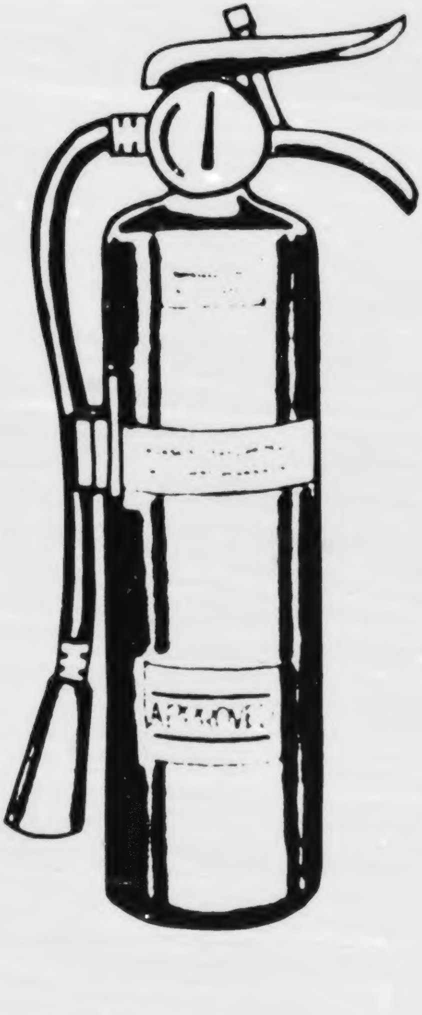
POLICE YOUR WORK AREA

1151

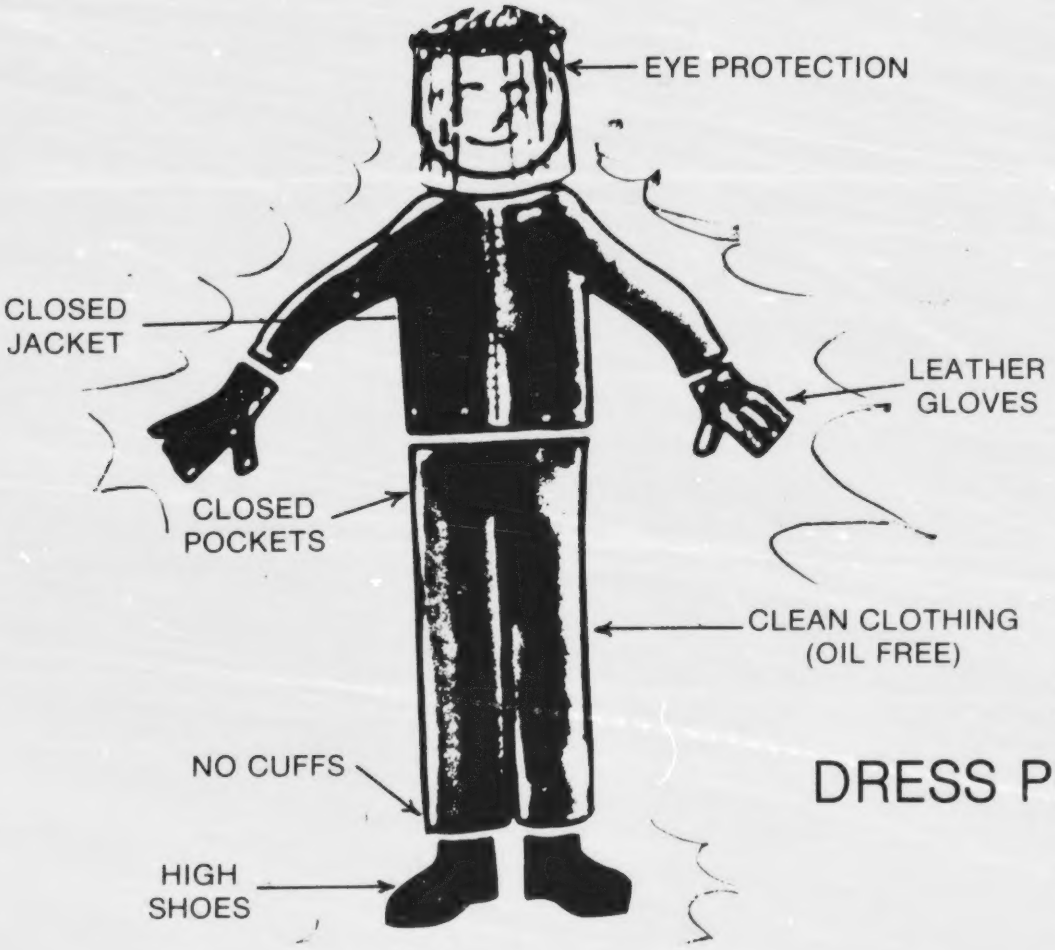

NO SMOKING
KEEP THIS AREA CLEAN
OXYGEN STORAGE

STORAGE OF CYLINDER VALVES

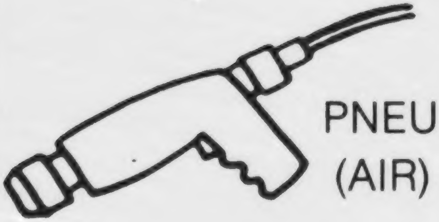
1153

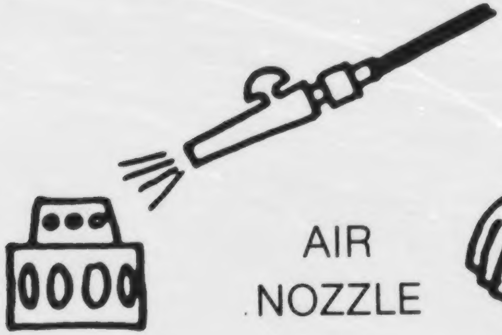


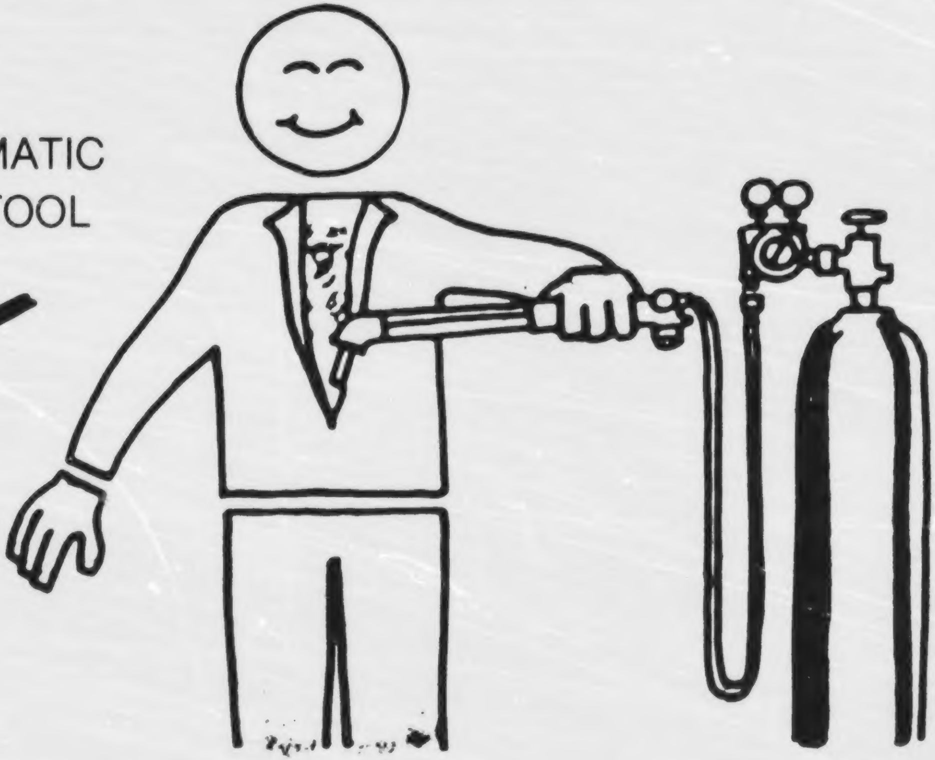
FIRE PROTECTION


EYE PROTECTION
CLOSED JACKET
LEATHER GLOVES
CLOSED POCKETS
CLEAN CLOTHING (OIL FREE)
NO CUFFS
HIGH SHOES

DRESS PROPERLY

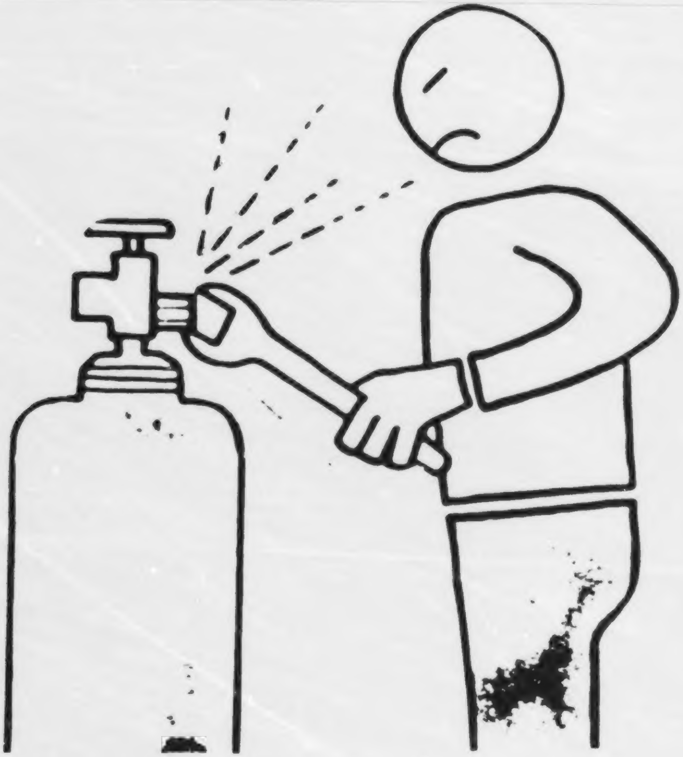

PNEUMATIC
(AIR) TOOL


AIR
NOZZLE
PERSONAL
VENTILATION
NEVER



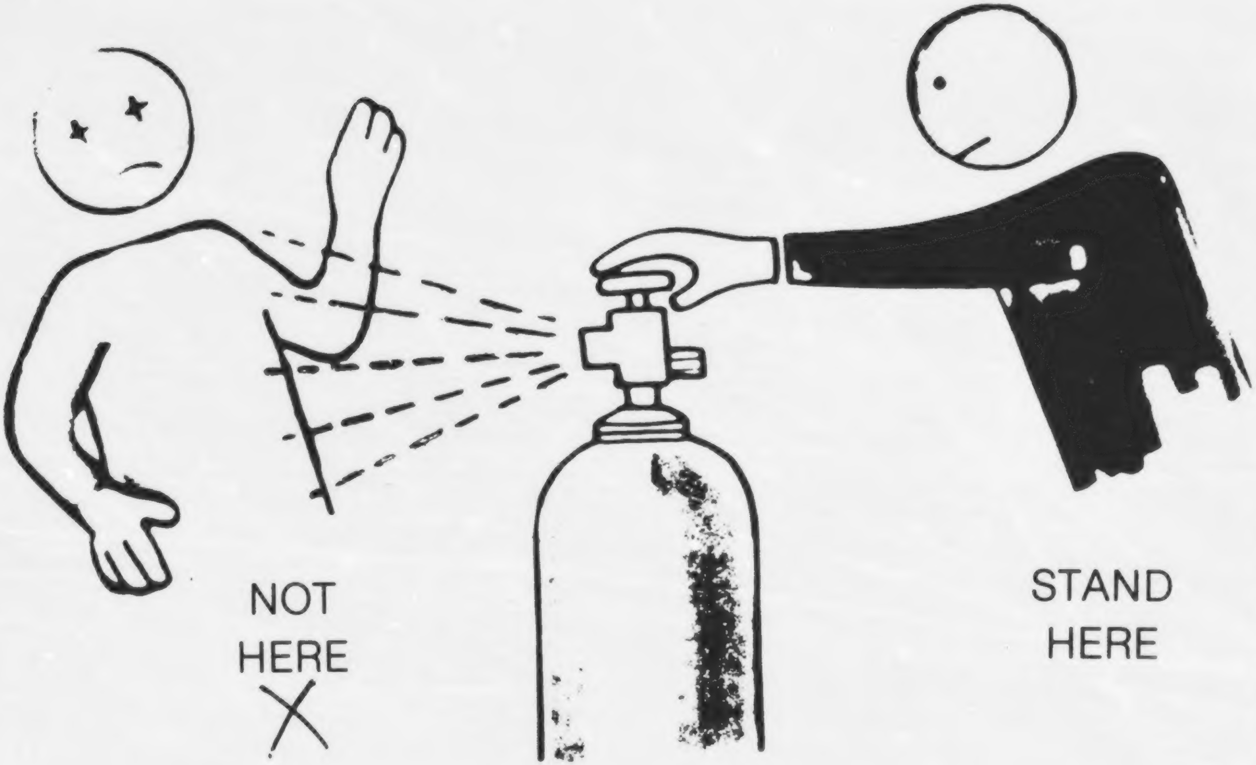
USE YOUR TOOLS CORRECTLY

1159

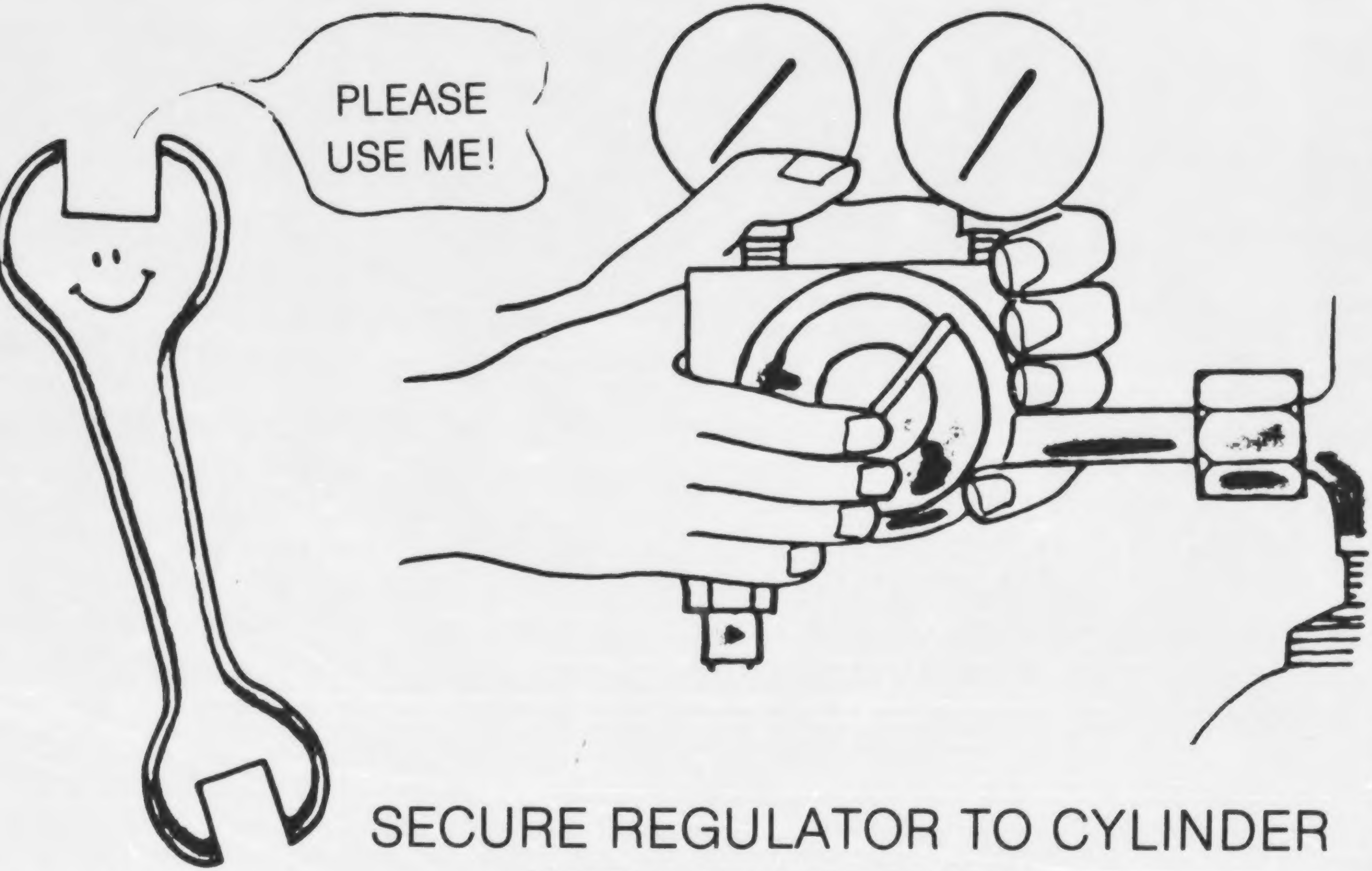


DON'T TAMPER WITH

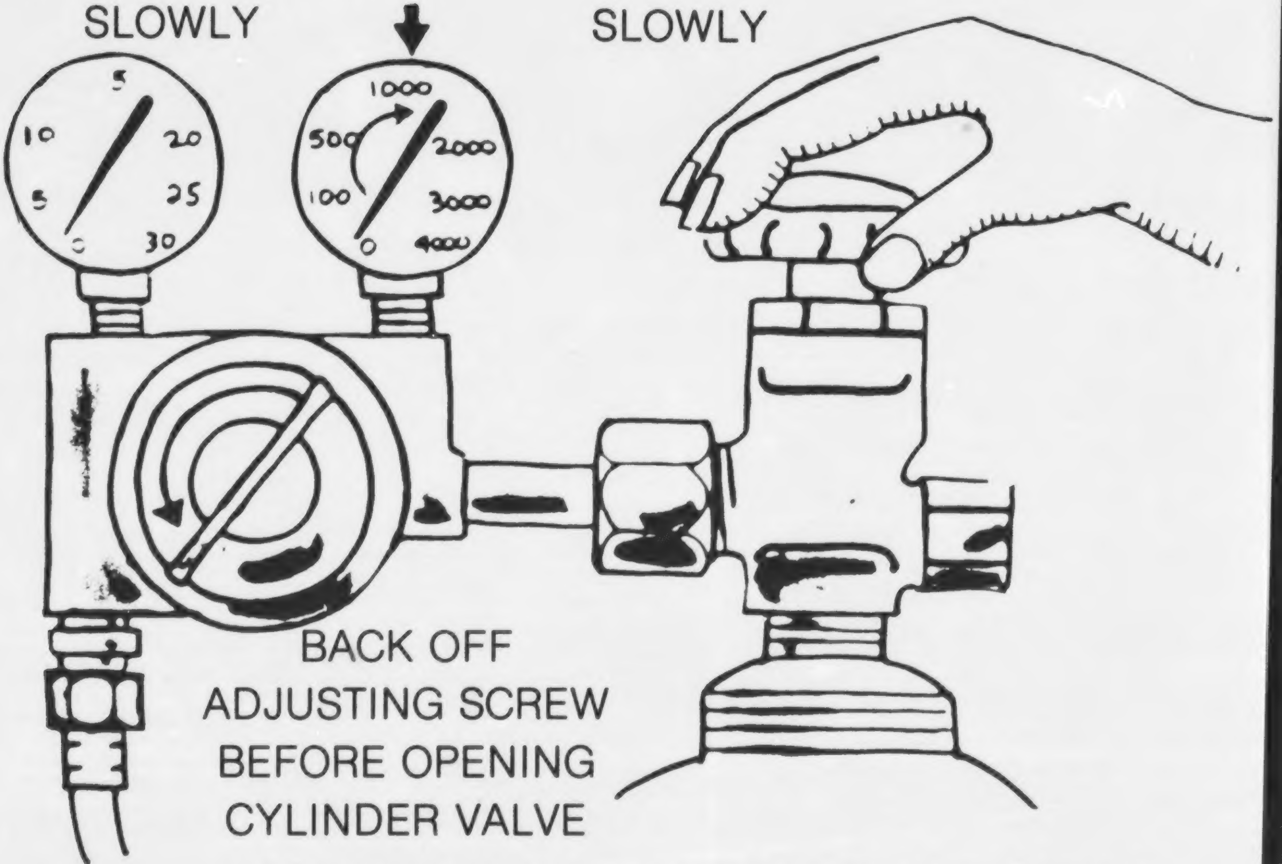
CYLINDER SAFETY DEVICES


NOT
HERE
STAND
HERE

CRACKING OF CYLINDER VALVES


PLEASE USE ME!

SECURE REGULATOR TO CYLINDER WITH PROPER WRENCH

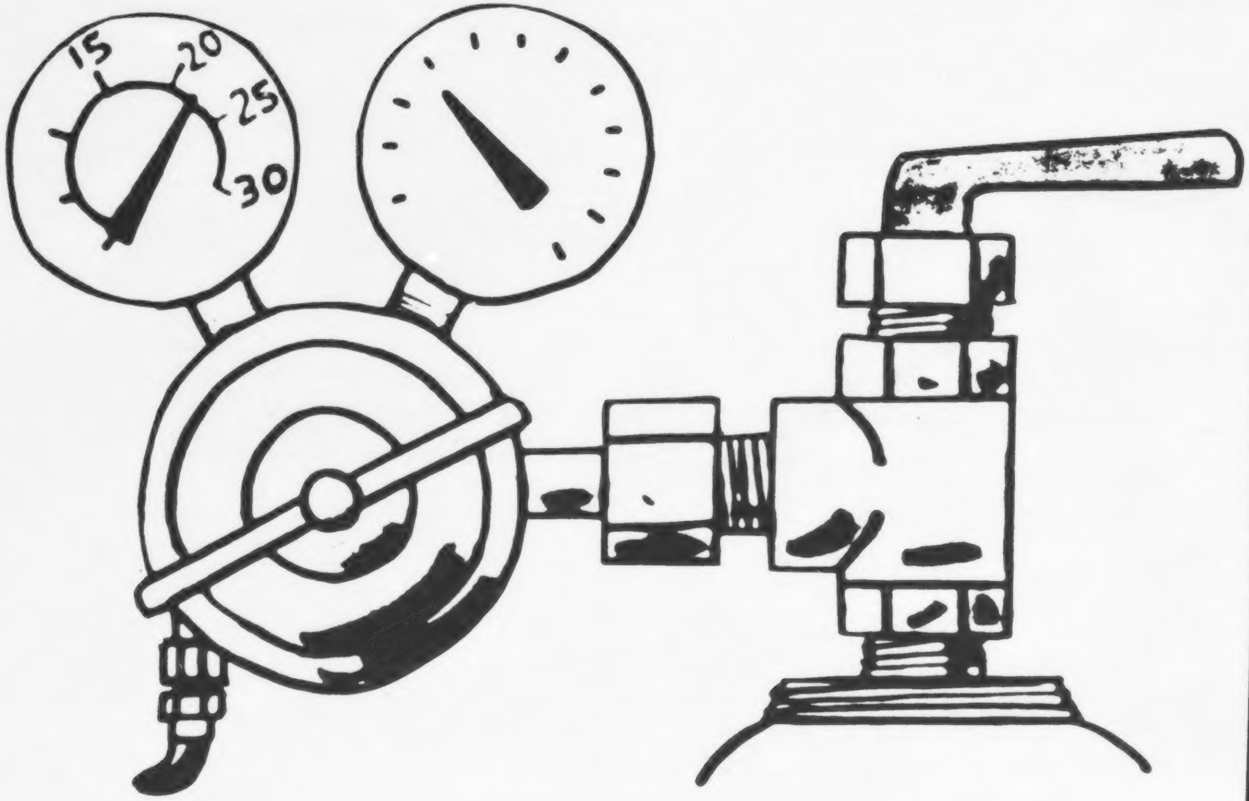

1000
500
2000
100
3000
0
4000
5
10
20
5
25
0
30

BUILD PRESSURE SLOWLY

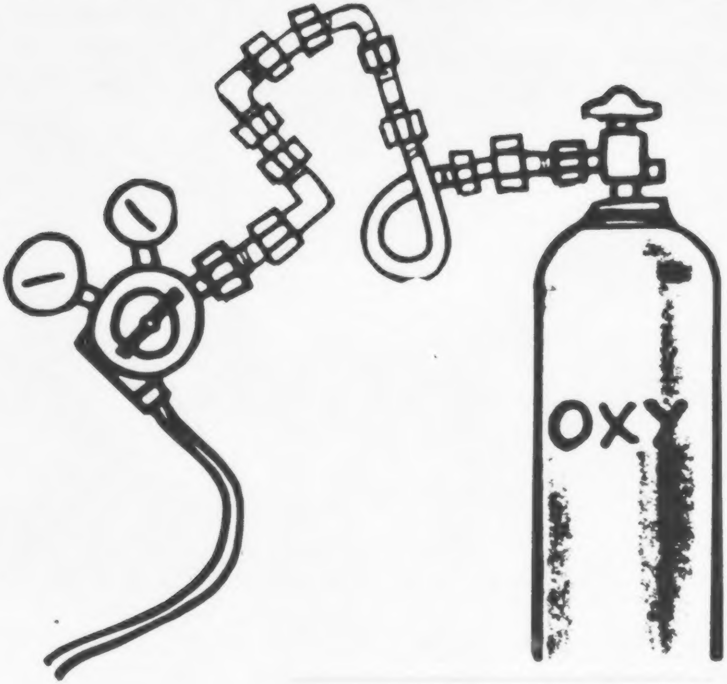
ROTATE SLOWLY

BACK OFF ADJUSTING SCREW BEFORE OPENING CYLINDER VALVE

OPEN CYLINDER VALVE SLOWLY



SAFE USE OF ACETYLENE


FUEL
GAS
REGULATOR
OXY

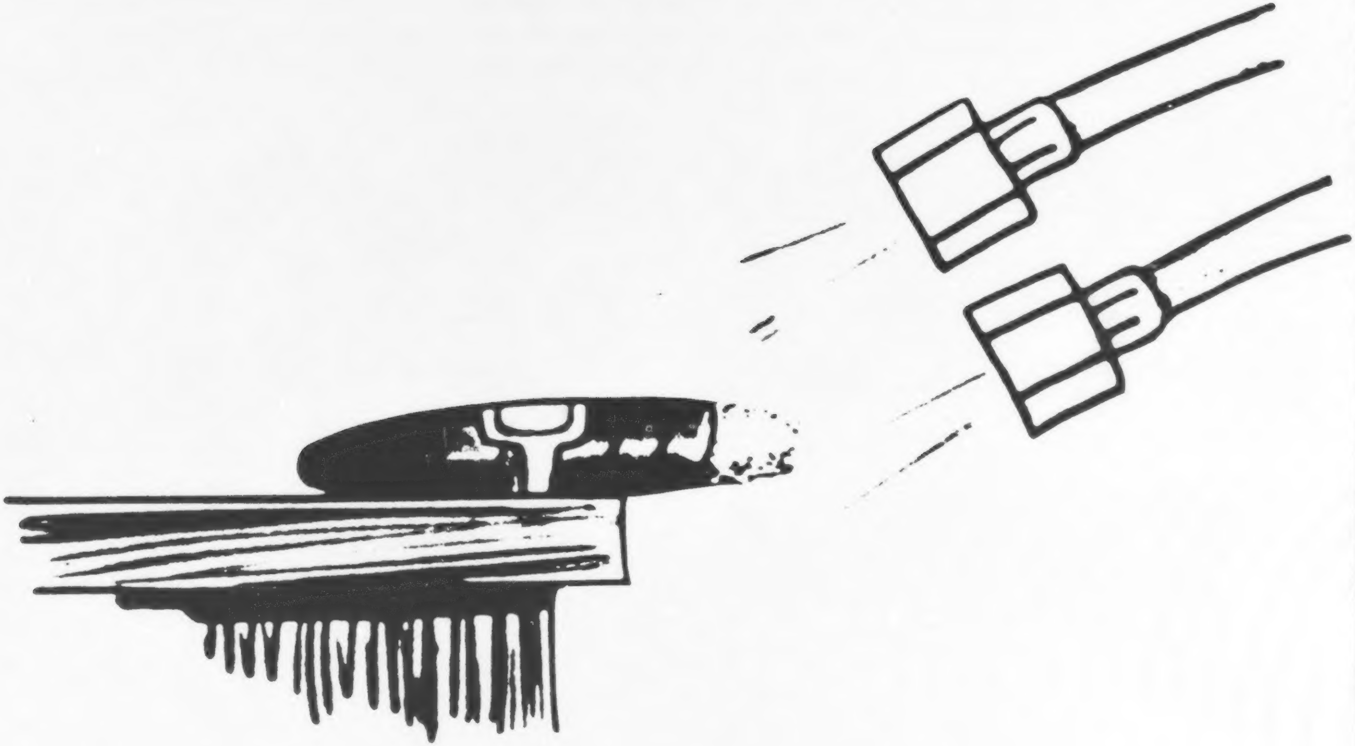
NEVER USE A REGULATOR FOR A GAS OTHER THAN THAT FOR WHICH IT WAS INTENDED

1171

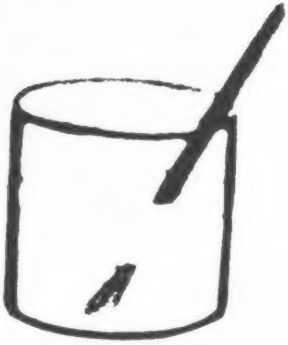
WELDING TIP
DATA CHART

TIP SIZE	OXY-ACETY PRESSURE P.S.I.G.
GXU-72	2
GXU-68	3
GXU-62	4
GXU-58	5
GXU-55	5
GXU-53	6
GXU-50	7
GXU-46	8
GXU-42	9
GXU-36	10
GXU-31	12

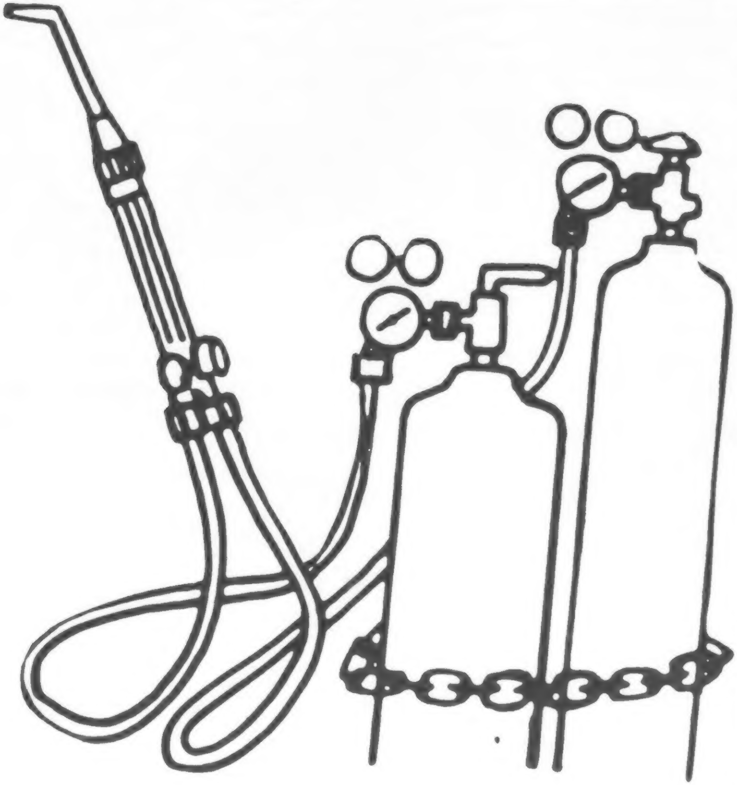
PROPER OPERATING PRESSURES



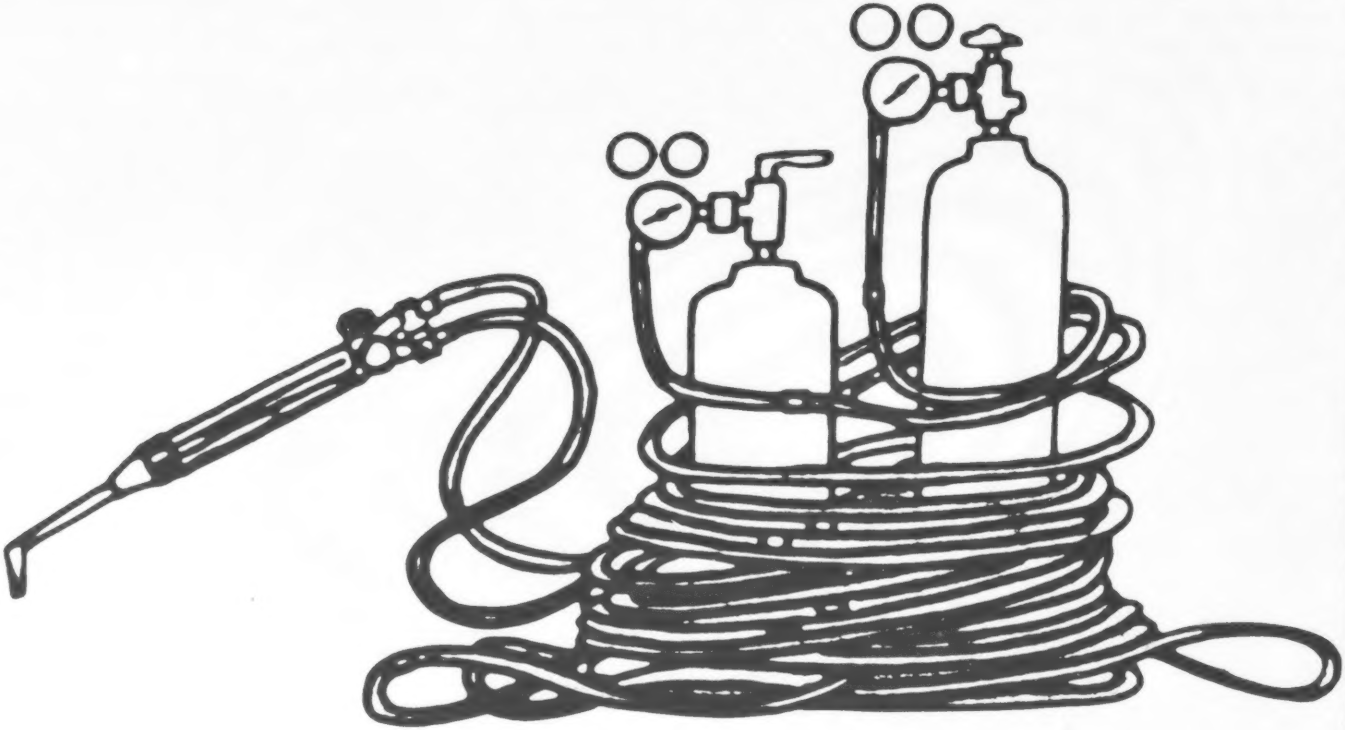
BLOWING OUT WELDING HOSE



SOAP WATER

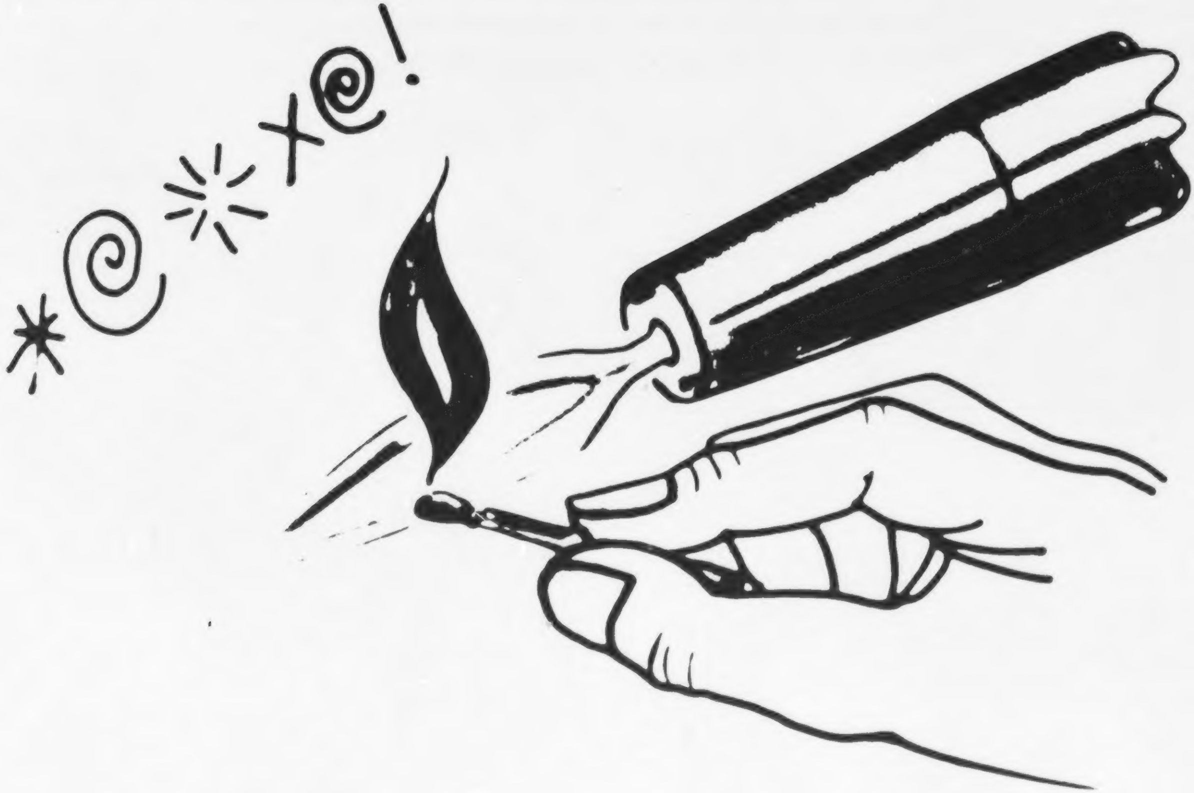


PRE-OPERATION SAFETY CHECK

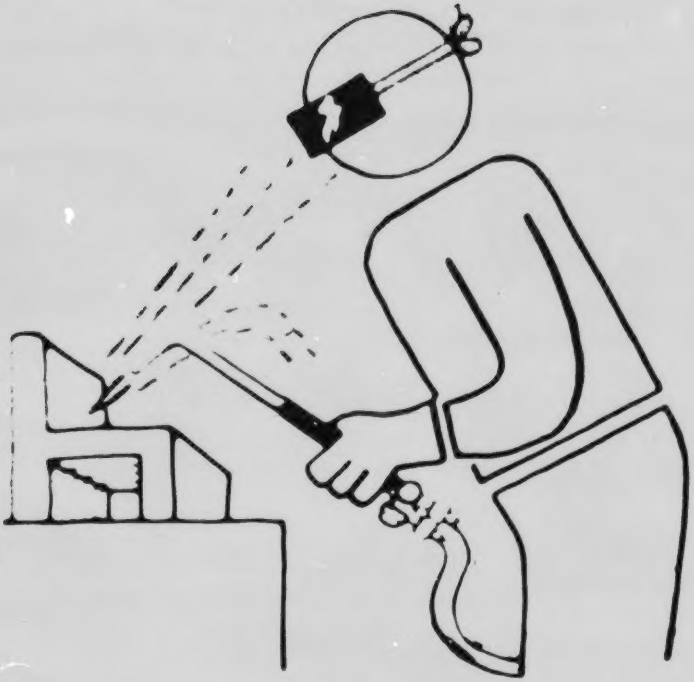


USE PROPER HOSE LENGTH

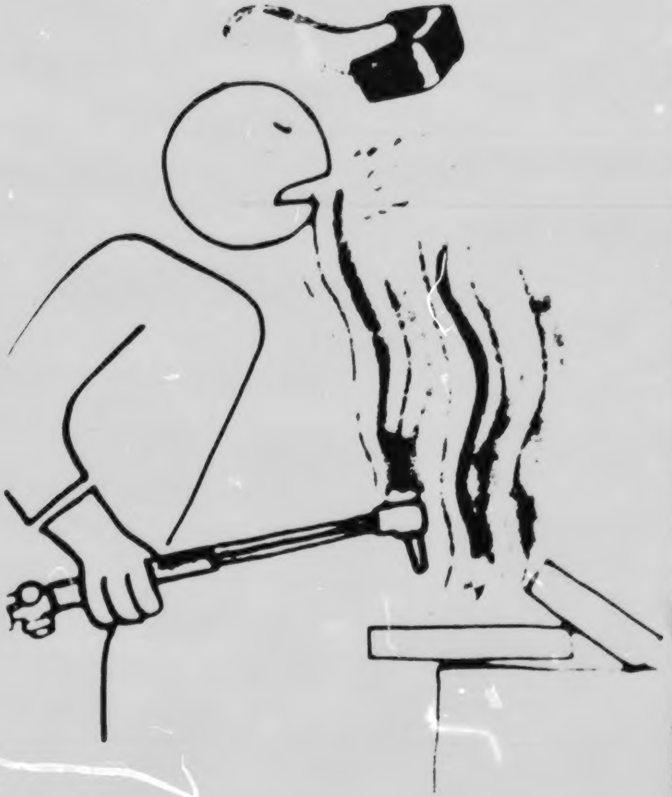
1179



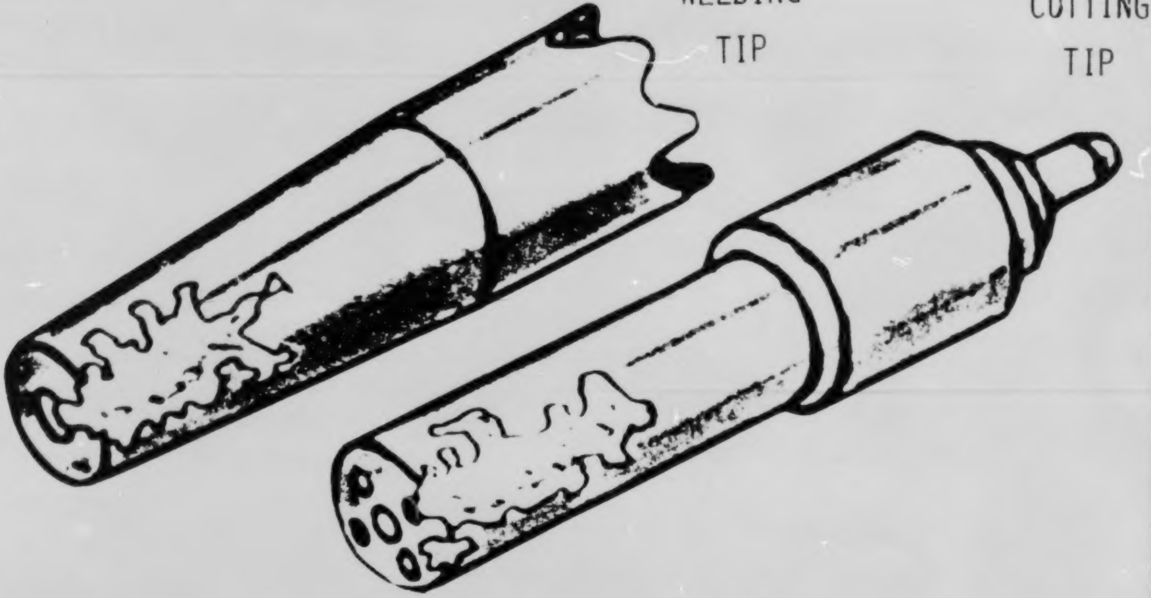
LIGHTING TORCH TIP



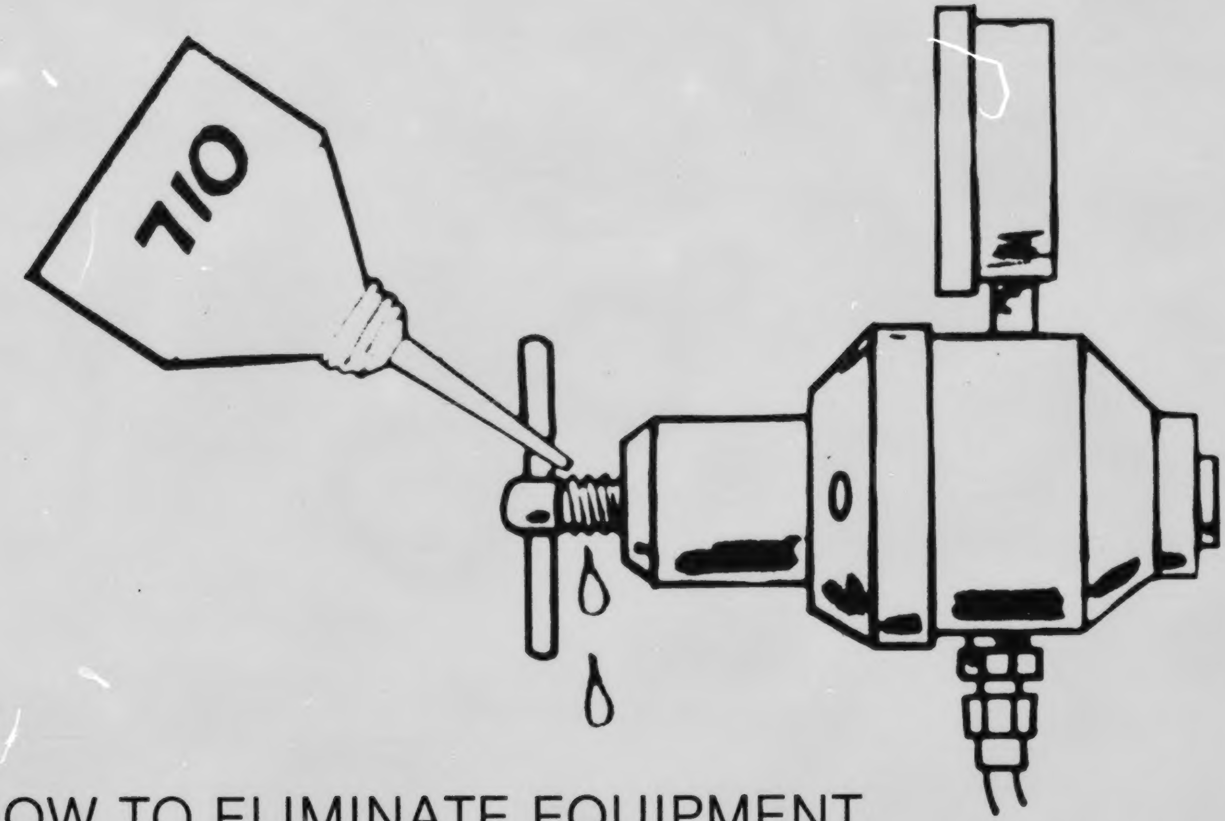
PROPER EYE PROTECTION



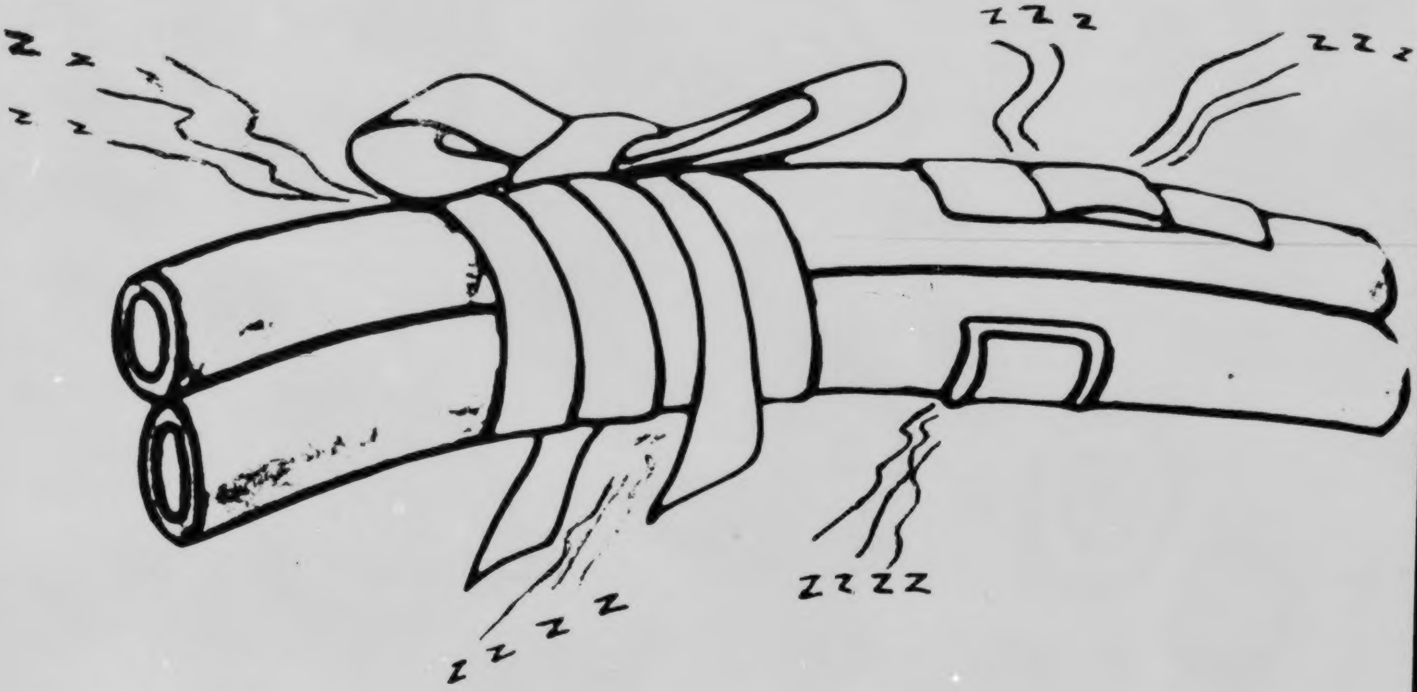
PROPER VENTILATION


WELDING TIP
CUTTING TIP

KEEP TIPS CLEAN



HOW TO ELIMINATE EQUIPMENT "SQUEAKS" AND "YOURSELF"


Z Z Z
Z Z
Z Z Z
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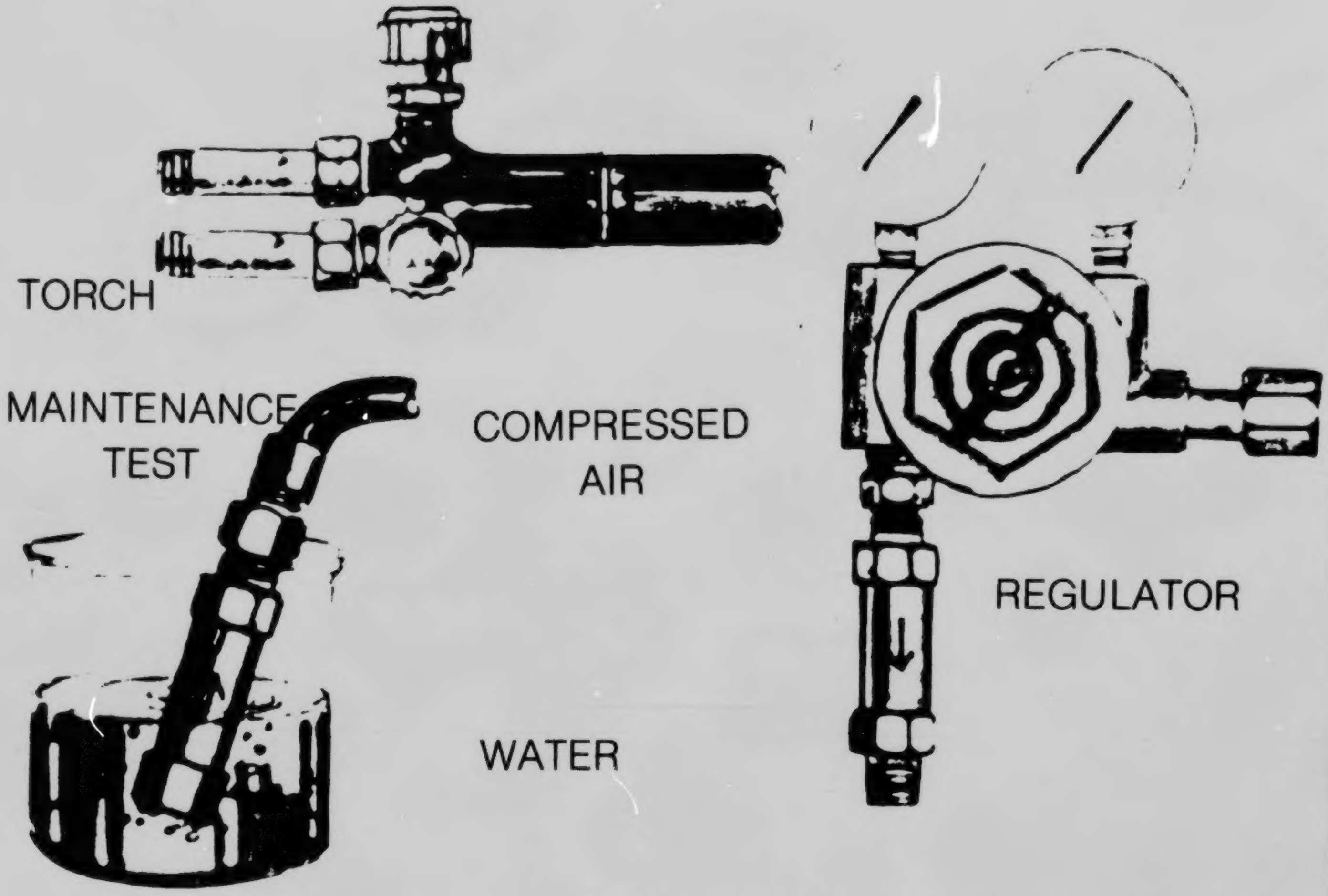
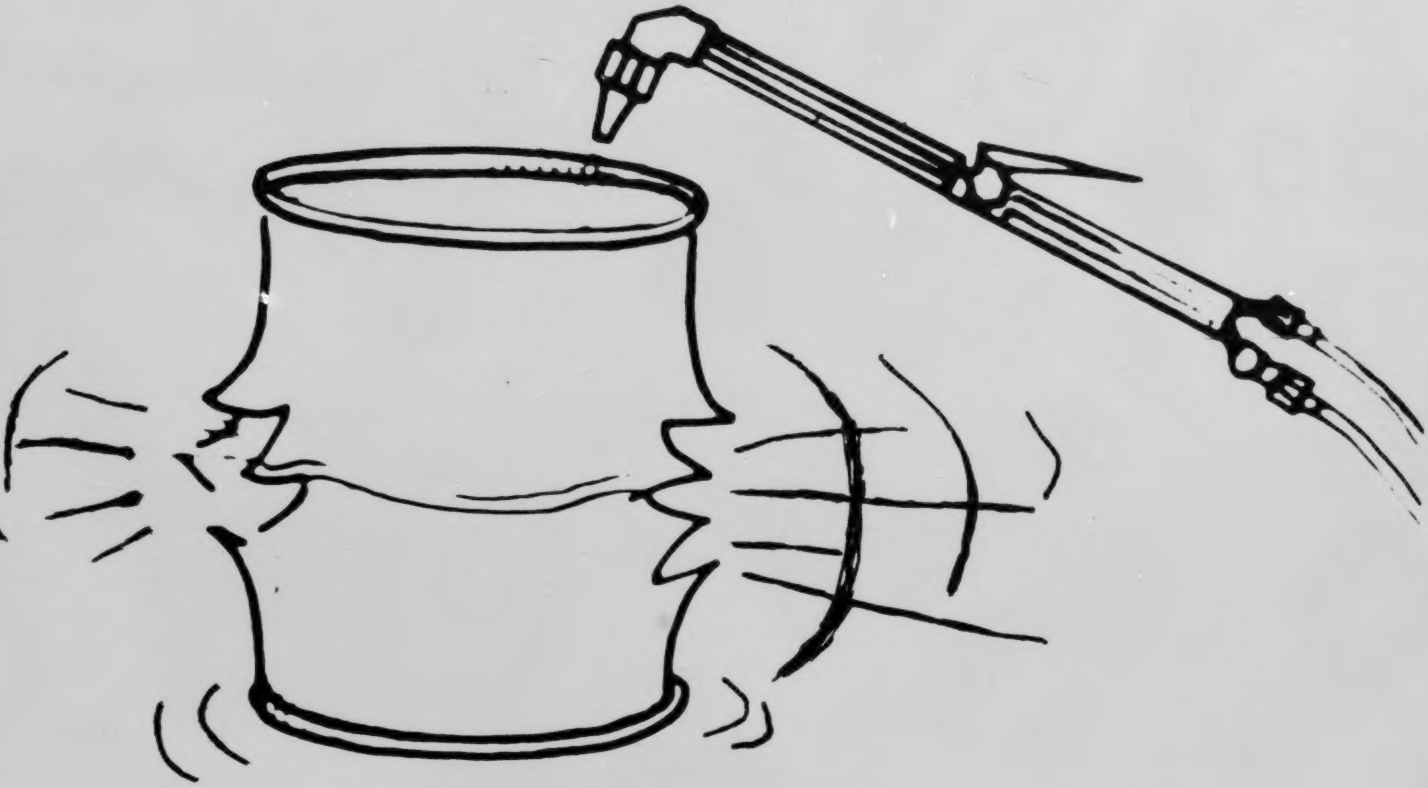
Z Z Z Z Z

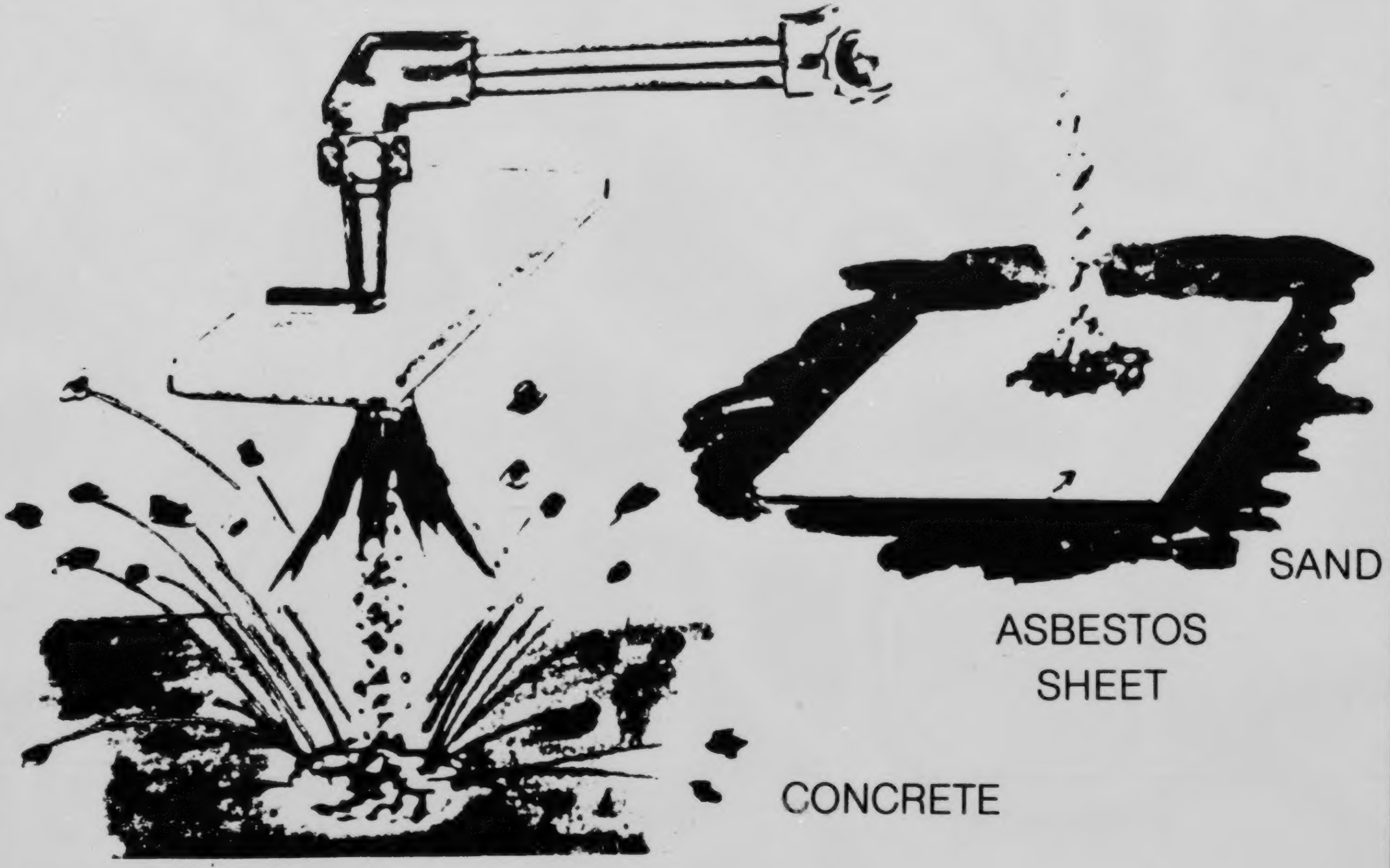
WORN WELDING HOSE
DO NOT REPAIR!-
REPLACE!!!


TORCH
MAINTENANCE
TEST
COMPRESSED
AIR
REGULATOR
WATER

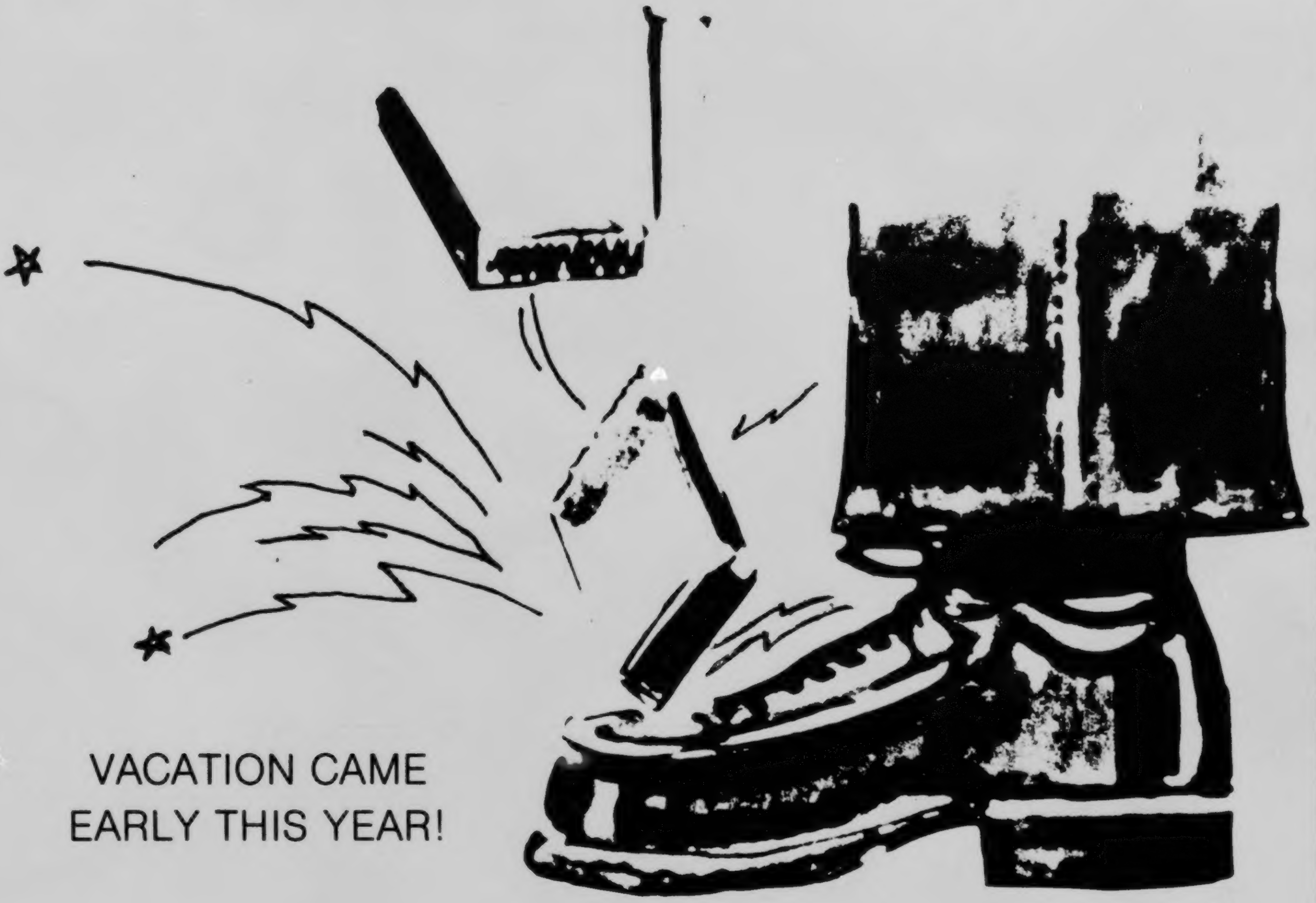
MAINTAIN BACK-FLOW CHECK VALVES



CAUTION! - THE NEXT CUT MADE
MAY BE YOUR THROAT!

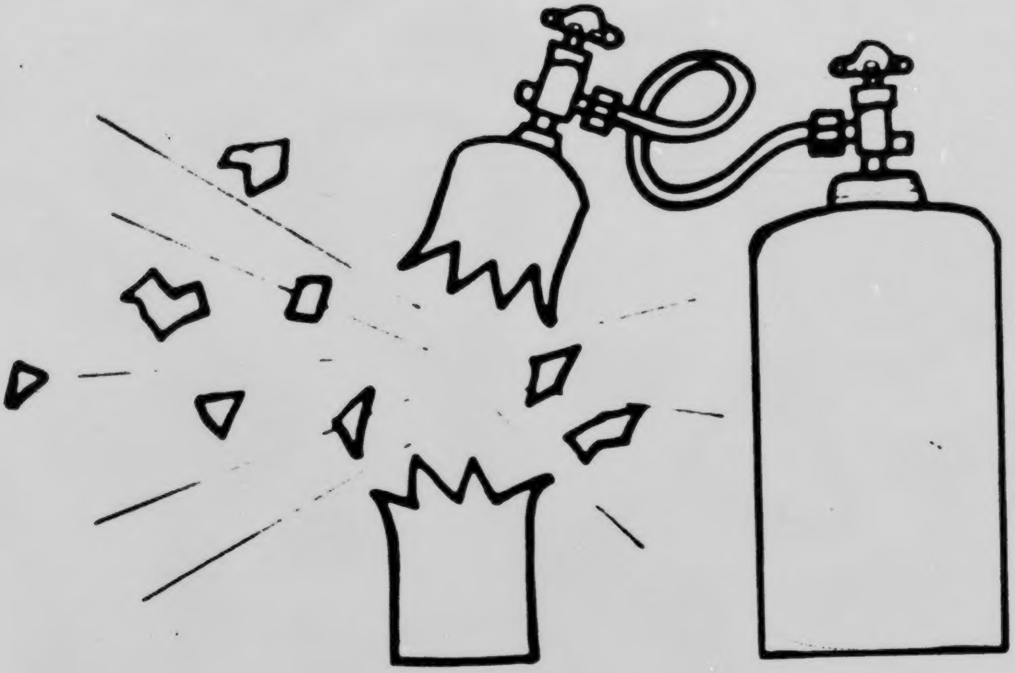

SAND
ASBESTOS SHEET
CONCRETE

BEWARE OF FLYING CONCRETE CHIPS!



VACATION CAME
EARLY THIS YEAR!

1197



LEAVE FILLING OF CYLINDER
TO THE MANUFACTURER

RECOMMENDED SAFETY PUBLICATIONS

SAFETY-IN WELDING AND CUTTING, AMERICAN NATIONAL STANDARD Z49.1, ISSUED BY THE AMERICAN WELDING SOCIETY,2501 NORTHWEST 7th STREET MIAMI, FLORIDA 33125.

CUTTING AND WELDING PROCESSES, N.F.P.A. STANDARD NO. 51B, ISSUED BY THE NATIONAL FIRE PROTECTION ASSOCIATION, 470 ATLANTIC AVE., BOSTON, MASS. 02210.

REGO WELDING AND CUTTING HANDBOOK, STOCK NO. 400124, OBTAINABLE AT YOUR LOCAL REGO WELDING EQUIPMENT DISTRIBUTOR.

REFERENCES

Materials were selected and reviewed from the following sources, and in some instances were incorporated in the production of the preceding unit.

1. Airco Welding Products
2. American Welding Society
3. Miller Electric Manufacturing Company
4. National Institute for Occupational Safety and Health - U.S. Dept. of Health, Education, and Welfare
5. Occupational Safety and Health Administration, U. S. Department of Labor
6. Rego Company
7. Rexarc Inc.
8. University of Illinois, College of Agriculture
9. Utah State Dept. of Ed., Industrial Education Safe Guide
10. Victor - Welding and Cutting Division
11. Washington State Dept. of Education, Industrial Arts Safety Guide

WOODWORKING EQUIPMENT

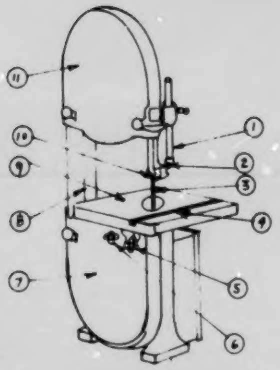
Woodworking Machine Hazards

This table is the reported data resulting from an 18-month, 5-state survey published by NIOSH under the title: "Machine Guarding--Assessment of Need," 1975. The table categorizes those hazards that are normally associated with the various woodworking machines.

While the pupil will not be exposed to all of the listed machines during his/her high school experiences, he/she may operate one in industry and should be aware of the potential hazards.

	HAZARD							
MACHINE TYPE	Chemical	Cutting	In-Running Nip Points	Reciprocating/Transverse	Rotating	Shattering	Thermal	TOTAL
1. Cut-Off Saws		X		X	X			3
2. Power Rip Saws		X		X	X			3
3. Shapers		X			X	X		3
4. Belt Sanders	X	X	X	X	X	X	X	7
5. Band Saws		X			X			2
6. Jointers		X		X	X			3
7. Planers		X	X	X	X			4
8. Lathes		X			X			2
9. Molders		X	X	X	X			4

BAND SAW



1. GUIDE POST
2. BLADE SUPPORT LOCK SCREW
3. BLADE
4. MITER GAGE GROOVE
5. TABLE CLAMP
6. ADJUSTING SCREW FOR BLADE GUIDES
7. LOWER WHEEL GUARD
8. REAR BLADE GUARD
9. TABLE
10. BLADE GUIDES
11. UPPER WHEEL GUARD

1. All portions of the saw blade are required to be covered, except at the point of operation. (OSHA)

2. The wheels of the band saw shall be completely enclosed by metal. (OSHA)

3. The band saw shall be equipped with a tension control device. (OSHA)

4. A suitable guard of in-running feed roll must be maintained. (OSHA)

5. One must obtain permission from the teacher before using the band saw for the first time.

6. Only stock that is in good shape should be cut.

7. All guards must be in the right place.

8. Adjustments should be made only when the machine is at a DEAD STOP.

9. The upper saw guide should be set ONE-QUARTER INCH or less above the work.

10. All special setups should be checked with the teacher.

11. Only the operator should be inside the operator's safety zone.

12. The material must be held firmly and the fingers kept a safe distance away from the saw blade.

13. The saw blade should be kept from twisting or binding when cutting curves.

14. The machine must be allowed to come to a dead stop before backing the blade out of a long cut.

15. One should STEP AWAY IMMEDIATELY IF THE SAW BLADE BREAKS OR COMES OFF. The power should be shut off, if possible, and the teacher notified after all movement has stopped.

16. The power should be turned off after using and one should stand by until the machine has stopped.

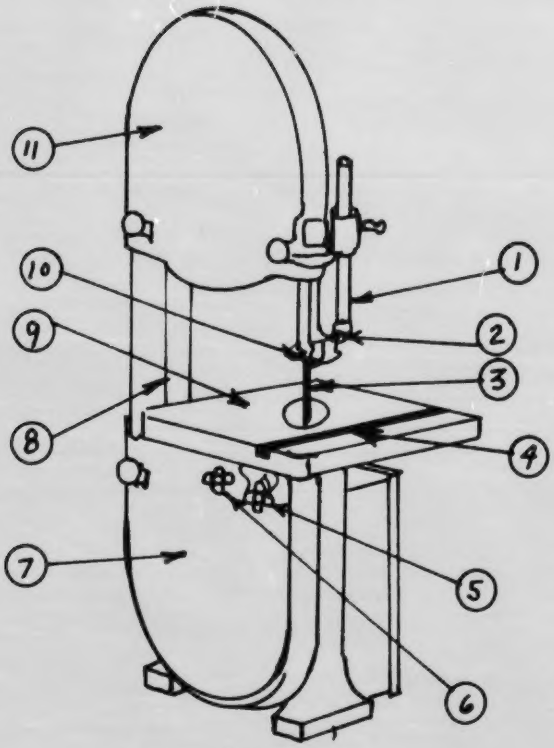
17. Scraps of wood on the table should be cleared away only after the blade stops running.

18. If help is needed to support heavy or long work, the helper must never pull or guide the work. The helper supports the weight; the operator runs the machine.

19. Cylindrical stock must not be cut on the band saw. It is likely to roll in the hands.

20. Relief cuts must be made before cutting the outline of sharp curves.

BAND SAW



1 Guide post

2 Blade support lock screw

3 Blade

4 Miter gauge groove

5 Table clamp

6 Adjusting screw for blade guides

7 Lower wheel guard

8 Rear blade guard

9 Table

10 Blade guides

11 Upper wheel guard

BAND SAW SAFETY QUIZ

NAME______________________________

CLASS______________________________

DATE__________GRADE______________

True-False:

T F 1. The upper guard should be adjusted to 1/4" above the stock.

T F 2. A person who is assisting a fellow pupil should stand to the right of the blade.

T F 3. The teeth of the band saw blade should be pointed up at the point-of-operation.

T F 4. One who is cutting curves should first make relief cuts.

T F 5. It is not difficult to make adjustment on the band saw, but it must be at a dead stop.

T F 6. The roller bearing on the guide is to prevent the blade from being pulled from the lot when backing out.

T F 7. If a blade breaks one needs to get a fellow pupil to stop the machine.

T F 8. A bench brush should be used to clean chips and dust from the table.

T F 9. The saw should be running at full power before cutting material.

T F 10. The operator's hands should never be in a direct line with the blade.

Multiple Choice:

______ 11. When starting the band saw, the operator should stand:

A. to the right of the saw blade.
B. to the left of the saw blade.
C. in front of the saw.
D. behind the saw.

______ 12. If the band saw blade should break or come off the wheels, one should:

A. shut off the power and stand clear.
B. continue cutting.
C. move the stock away to avoid damage.
D. call another pupil.

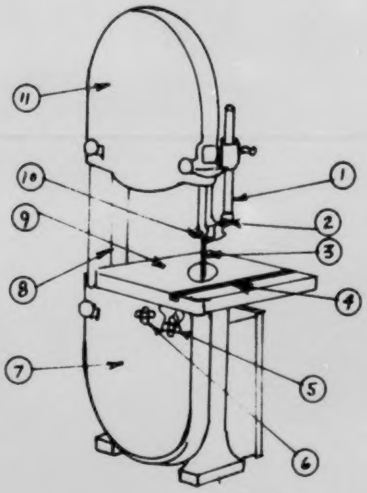
______ 13. If it becomes necessary to back out on a long cut, one should:

A. try to make a sharp turn on the blade.
B. continue to push the stock forward.
C. stop the machine and back the stock off.
D. carefully back the stock away from the blade.

______ 14. The upper saw guide of the band saw should be set:

A. when the saw is coasting.
B. tightly against the stock.
C. 1/2 inch above the stock.
D. 1/4 inch or less above the stock.

15. The correct names of the band saw parts should be given as indicated in the following drawing:



1.____________________

2.____________________

3.____________________

4.____________________

5.____________________

6.____________________

7.____________________

8.____________________

9.____________________

10.____________________

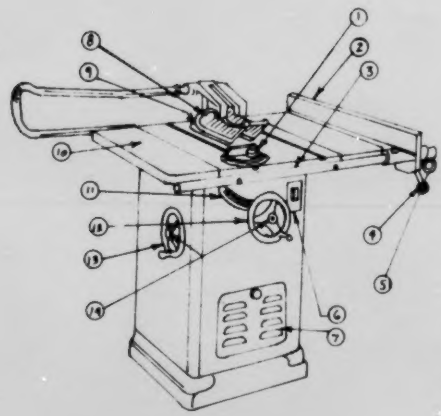
11.____________________

Signed____________________
Pupil

____
Date

____
Teacher

CIRCULAR TABLE SAW



1. MITER GAUGE
2. FENCE
3. GUIDE BAR
4. FENCE CLAMP
5. FENCE MICRO-SET KNOB
6. SWITCH
7. CLEAN-OUT
8. SAW GUARD
9. BLADE INSERT
10. TABLE
11 TILT SCALE
12. RAISING HANDWHEEL
13. TILT HANDWHEEL
14. LOCK KNOB

1. Circular table saws are required to be equipped with the following protective devices:

    A. A hood to completely enclose that portion of the saw above the table and material being cut.

    B. A spreader to prevent the material from squeezing the blade.

    C. Non-kickback fingers or dogs to prevent the material from being thrown back at the operator. (OSHA)

2. Teacher's permission should be obtained before using the table saw.

3. All lumber must be free from loose knots, nails, paint, or pebbles

4. The proper saw blade should be selected and installed for the work to be done.

5. The blade must be sharp and free of cracks or other defects.

6. Adjustments should be made only when the machine is at a "dead" stop.

7. The saw blade extension should be limited to 1/8 inch or less above the stock being cut. Opinions may differ so check with the teacher.

8. All guards and other safety devices must be in their proper positions.

9. A ripping fence or cutoff gauge should be used when cutting material.

10. The teacher should be asked to approve all special setups.

11. A clearance block must be used when ripping fence is used as a gauge.

12. An adequate number of proper push sticks must be available.

13. No one but the operator should be inside the safety zone.

14. A face shield or safety glasses shall be worn.

15. The operator should stand to one side of the line of the saw blade.

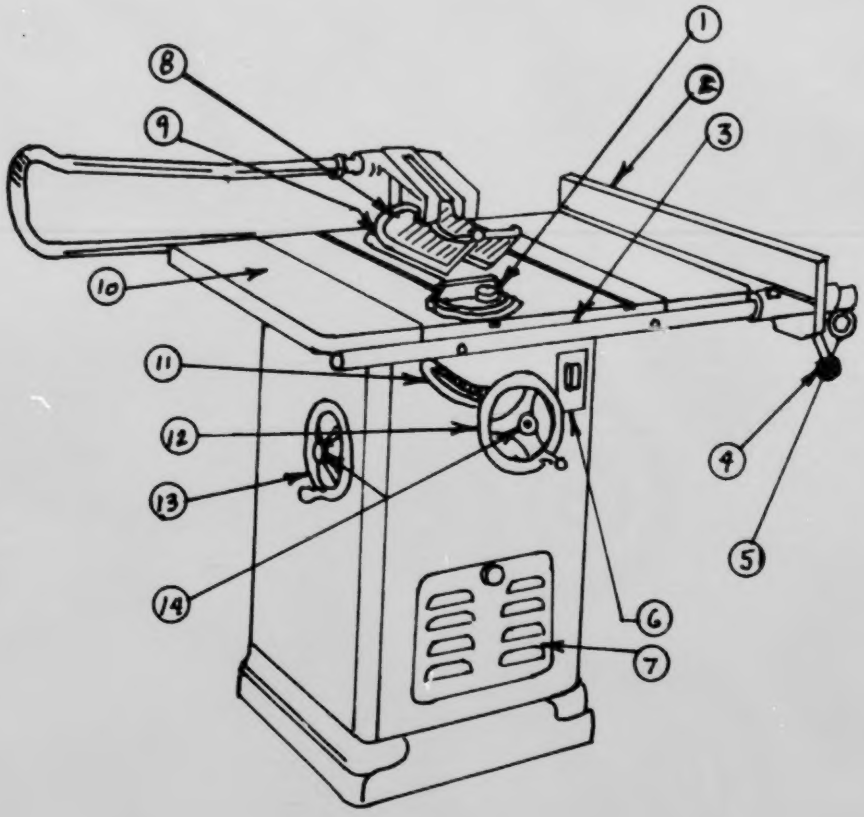
16. Fingers or any part of the hands must be kept clear of path to the saw blade.

17. The operator must stop the saw and move out of the operating zone before responding to anyone trying to attract his/her attention.

18. The stock should be fed only as fast as the saw will freely cut.

19. The stock should be pushed only by the operator. A push stick should be used when ripping narrow pieces of stock.

CIRCULAR TABLE SAW



1	Miter gauge	8	Saw guard
2	Fence	9	Blade insert
3	Guide bar	10	Table
4	Fence clamp	11	Tilt scale
5	Fence micro-set knob	12	Raising handwheel
6	Switch	13	Tilt handwheel
7	Clean-out	14	Lock knob

CIRCULAR TABLE SAW SAFETY QUIZ

NAME ______________________

CLASS ______________________

DATE ___________ GRADE______

True-False:

T F 1. The blade should not be raised more than 1/8 inch above the stock.

T F 2. The fence and miter gauge can be used at the same time to crosscut.

T F 3. Free hand sawing is not permitted.

T F 4. All special set-ups must be checked by the teacher.

T F 5. A person may rip a seven foot long board by himself/herself, using the table saw.

T F 6. It is best to stand directly behind the blade when ripping.

T F 7. A spreader is used when ripping, to keep the material from pinching the blade.

T F 8. One may reach over the saw blade to help guide the stock being cut.

T F 9. Guards shall be left on the machine at all times.

T F 10. A person using a dado head should check to make sure all the chisel blades are pointed toward the operator.

T F 11. A push stick should be used when one is ripping stock under three inches wide.

T F 12. Blades for the circle saw that are dull may be used because of the speed and power of the saw.

Multiple Choice:

_____13. A person who is operating the circle saw should stand:

A. to the right side of the blade.
B. to the left side of the blade.
C. directly behind the blade.
D. anywhere--it makes no difference.

_____14. Crosscutting stock requires the use of a:

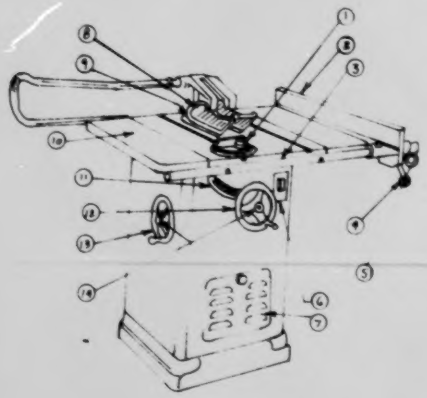
A. fence.
B. miter gauge.
C. stop block.
D. push stick.

_____15. All circular saws adjustments should be made:

A. after the fence has been removed from the table top.
B. while the saw is in motion.
C. according to the blade being used.
D. when the saw blade is completely stopped.

16. Identify all the circle saw parts indicated in the drawing:

1. ____________________
2. ____________________
3. ____________________
4. ____________________
5. ____________________
6. ____________________
7. ____________________
8. ____________________
9. ____________________
10. ____________________
11. ____________________
12. ____________________
13. ____________________
14. ____________________

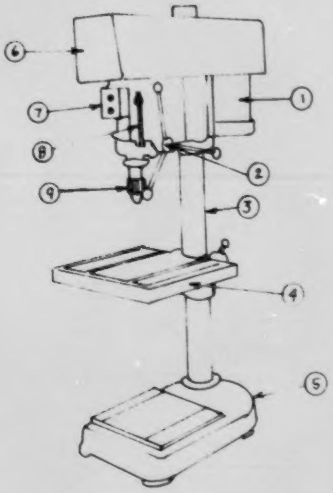


Signed ____________________
Pupil

____
Teacher

Date ____________________

DRILL PRESS



1. MOTOR
2. PILOT WHEEL FEED
3. COLUMN
4. TABLE
5. BASE
6. BELT GUARD
7. SWITCH
8. DEPTH STOP
9. QUILL

1. All belts and pulleys shall be guarded. (OSHA)

2. The teacher's permission must be obtained before using the drill press.

3. The operator should make sure the table is secure and the depth adjustment set before turning on the power (aim for the center hole to avoid drilling into the table).

4. The drive belt must be on the correct pulleys for the desired speed (1200 - 3000 rpm for drilling wood).

5. One should never attempt to use a regular auger bit on the drill press or in the hand drill. Auger bits for this machine have the lead screw cut smooth and the square tang cut off.

6. The chuck key must be removed before turning on the power.

7. Small pieces should be clamped in a drill vise or clamped to the table.

8. A shop cap should be worn or the hair tied up when working around whirling machinery. Rings, wristwatches, and gloves should not be worn.

9. The drills must be ground in balance so that they do not tend to whip the work.

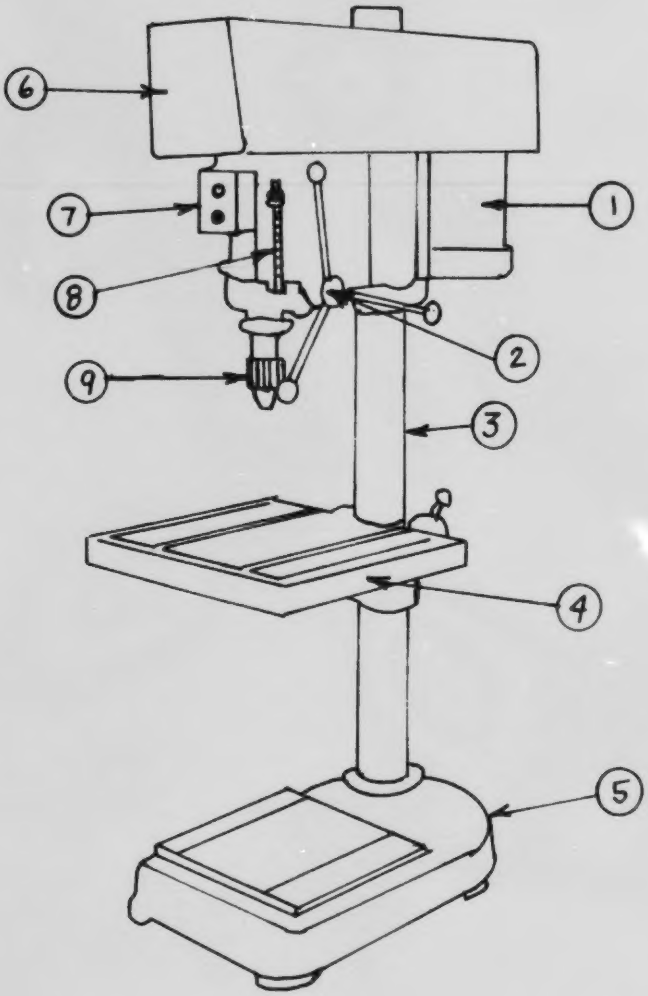
10. The operator should turn off the power and wait until the machine has come to a full stop before grabbing a piece of stock which has been caught up in the machine.

11. One should ease up on the feed pressure before breaking through the other side in order to prevent catching and having the work jerked out of the clamps or vise.

12. The drill should be fed slowly, and raised periodically, to avoid burning a bit.

13. The table and floor should be kept clean before and after using the machine.

DRILL PRESS



1 Motor
2 Pilot wheel feed
3 Column
4 Table
5 Base
6 Belt guard
7 Switch
8 Depth stop
9 Quill

DRILL PRESS SAFETY QUIZ

NAME ______________________________

CLASS ____________________________

DATE _______________ GRADE ______

True-False:

T F 1. It is necessary to select the proper speed.

T F 2. The chuck key should be kept in the chuck at all times to prevent losing it.

T F 3. The material to be drilled should be held in the hands.

T F 4. Long hair must be confined by a cap or tied back.

T F 5. Safety glasses need not be worn when using the drill press.

T F 6. The use of a drill vise or clamps is the proper procedure to follow in drilling materials.

T F 7. The operator should brush off the table with the hands when leaving the machine.

T F 8. The drill press should be unplugged when changing speed or belt position.

T F 9. All jewelry should be removed before using the drill press.

T F 10. Dull drill bits can burn material or grab it, and therefore should not be used.

T F 11. It is better to use a high speed when drilling harder material so one can get done faster.

Multiple Choice:

_____ 12. If the work is caught by the drill and starts to revolve, one should:

A. exert more feed pressure.
B. stop the machine immediately.
C. grab it with both hands.
D. decrease the feed pressure.

_____13. The safest way to remove chips or cuttings from the drill press is:

A. brush them away with the hands.
B. use an air hose.
C. blow them away.
D. use a brush.

_____14. Touching or grabbing the rotating chuck with the hands is:

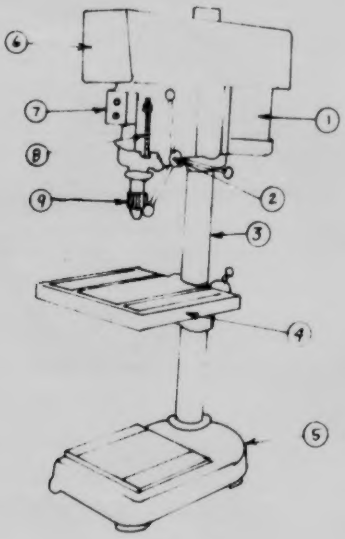
A. never permissible and very dangerous.
B. done to slow down or stop the chuck.
C. safe if a rag is used to protect the hands.
D. permissible if the teacher is watching.

_____15. Using the correct speed usually gets the following results:

A. keeps the bit from overheating.
B. it provides the proper cutting action.
C. it makes for safer working conditions.
D. it does all of the above.

604

16. Give the correct names for the parts of the drill press indicated in the following drawing:



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Signed ____________________
Pupil

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Date

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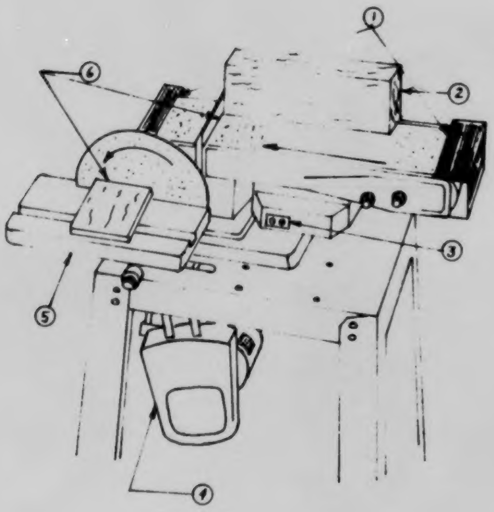
Teacher

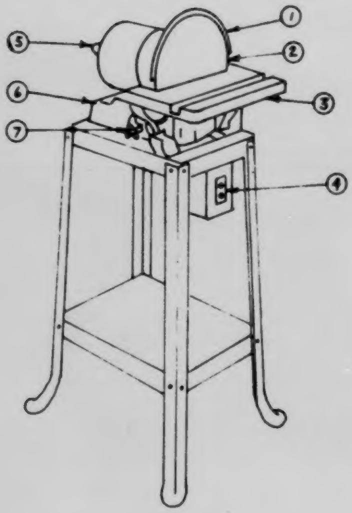
FINISHING MACHINE

(BELT AND DISC SANDER)



1. SAFETY GUARDS
2. FEED DIRECTION
3. SWITCH
4. POWER TRANSMISSION
5. TABLE
6. POINT-OF-OPERATION

(DISC SANDER)



1. GUARD
2. ABRASIVE DISC
3. TABLE
4. SWITCH
5. MOTOR
6. BASE
7. TABLE LOCK KNOB

1. Belt sanding machines are required to be equipped with guards at each nip point where the sanding belt runs on to a pulley. (OSHA)
2. Each disc sanding machine shall have enclosed the revolving disc, except for that portion of the disc above the table. (OSHA)
3. The machine must never be used without the authorized permission of the teacher.
4. Eye protection must be worn.

5. The clearance between the sanding disc and table or rest should not exceed 1/16 inch.

6. One should stand on the downside side of the spinning disc.

7. One must not attempt to hold small pieces in the hands. If a large number of small pieces must be sanded, a holding jig or device should be built.

8. All adjustments should be made while the machine is at dead standstill.

9. The sander should be stopped by shutting off the power. A scrap piece of material can be used to bring the wheel to a stop.

10. The sander should not be operated if the disc is loose. This condition should be reported to the teacher.

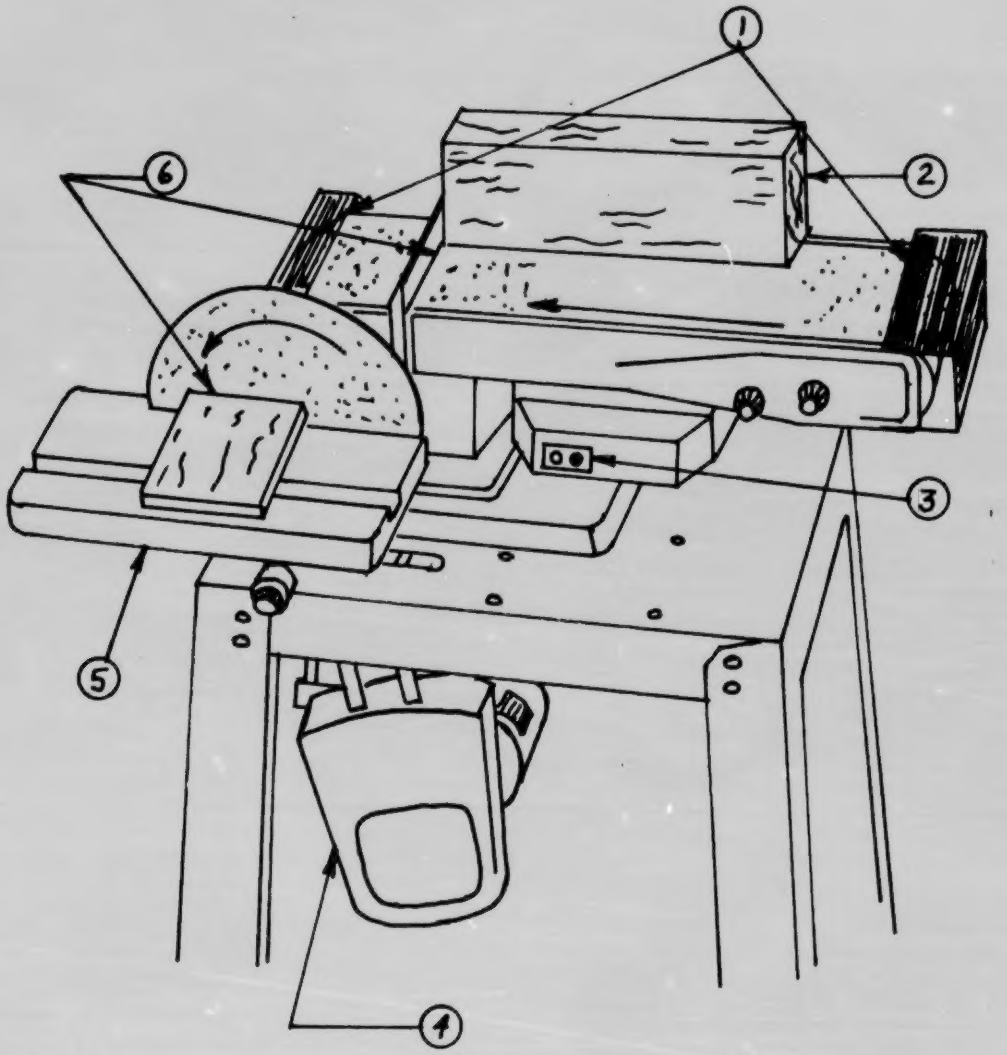
11. The material should be moved back and forth to avoid heating and burning of the disc.

12. The operator should always check the tightness of the belt.

13. The stock must be firmly against the stop to prevent the belt from throwing it.

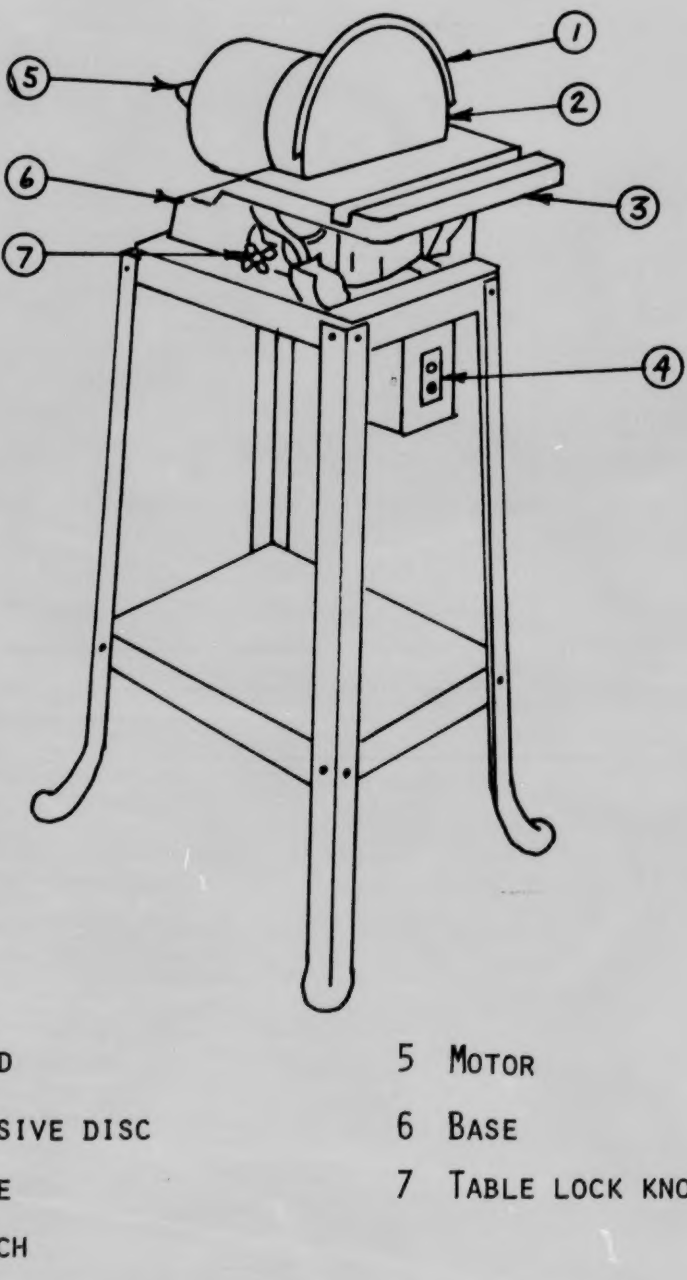
14. A push block should be used when sanding thin pieces of material. Both hands are to be kept on the push block.

FINISHING MACHINE
(BELT AND DISC SANDER)



1 Safety guards
2 Feed direction
3 Switch
4 Power transmission
5 Table
6 Point-of-operation

FINISHING MACHINE
(DISC SANDER)



1	GUARD	5	MOTOR
2	ABRASIVE DISC	6	BASE
3	TABLE	7	TABLE LOCK KNOB
4	SWITCH		

FINISHING MACHINE (BELT/DISC SANDERS) SAFETY QUIZ

NAME______________________________

CLASS______________________________

DATE____________GRADE______________

True-False:

T F 1. There is very little danger when using this machine.

T F 2. The clearance between the sanding disc and the table should not exceed 1/16 inch.

T F 3. When using the disc sander, one must stay on the up side of the spinning disc.

T F 4. Small pieces should be held in some type of holding device and not in the hands.

T F 5. After shutting off the power, the operator should use a scrap block and stop the wheel from spinning.

T F 6. The belt on the belt sander should be loose so it will not grab wood out of the operator's hands.

T F 7. When sanding thin stock, a push block must be used.

T F 8. Federal safety rules require that nip points on belt sanders be guarded.

T F 9. If the sanding disc becomes loose, one needs to press the stock against it harder.

T F 10. Adjustments can be made to a closer tolerance while the machines are running.

T F 11. The stock should be moved constantly to keep from burning both the disc and the stock.

T F 12. When using a belt sander, a stop should be used to keep the belt from throwing the stock.

Multiple Choice:

_____ 13. On the disc sander, the operator should sand against the disc.

A. center.
B. upward motion side.
C. rim.
D. downward motion side.

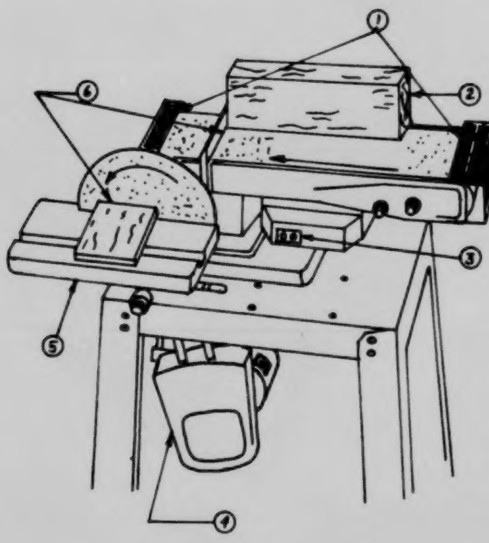
_____ 14. For best results, the stock should be fed into the sander.

A. with a gentle pressure.
B. at a fast speed.
C. with firm pressure.
D. at a slow speed.

_____ 15. When abrasives become full of pitch, they will cause:

A. the disc to tear.
B. the material to burn.
C. the disc to come off.
D. material to be jerked from the hand.

16. Identify the parts of the machines in the drawings:



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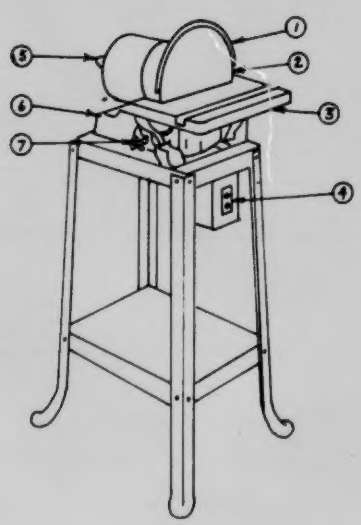

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Pupil

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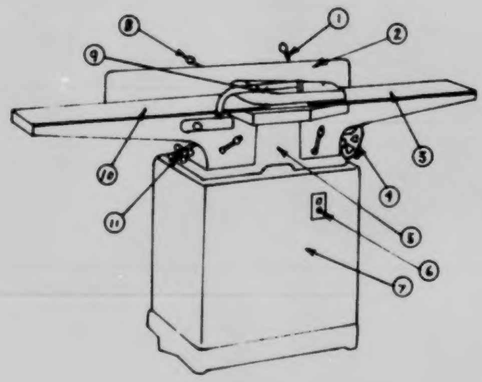
Teacher

Date____________________

JOINTER



1. FENCE TILTING LEVEL
2. FENCE
3. IN FEED TABLE
4. IN FEED TABLE ADJUSTING WHEEL
5. BASE
6. SWITCH
7. STAND
8. FENCE ADJUSTMENT LEVEL
9. FRONT GUARD
10. OUT FEED TABLE
11. OUT FEED TABLE ADJUSTING WHEEL

1. HAND-FED WITH HORIZONTAL HEAD: shall have a cylindrical cutting head with the knife projecting no more than 1/8 inch beyond the cylinder. (OSHA)

2. TABLE OPENINGS: the clearance between the rear table and cutter head shall be 1/8 inch, maximum. The table throat opening (when tables are set with each other for zero cut) shall be two and one half inches, maximum. (OSHA)

3. HORIZONTAL HEAD: shall have an automatic guard covering the head on the working side of the fence or gauge, and a guard covering the head back of the fence or gauge. (OSHA)

4. VERTICAL HEAD: shall have an exhaust hood or other guard completely enclosing the revolving head, except for a slot wide enough to perform work. (OSHA)

5. Operate only with the teacher's permission and after instruction has been received.

6. Remove jewelry, eliminate loose clothing, and confine long hair.

7. Make sure all guards are in place and operating correctly.

8. Always use the proper eye protection.

9. Make all adjustments with the power turned off.

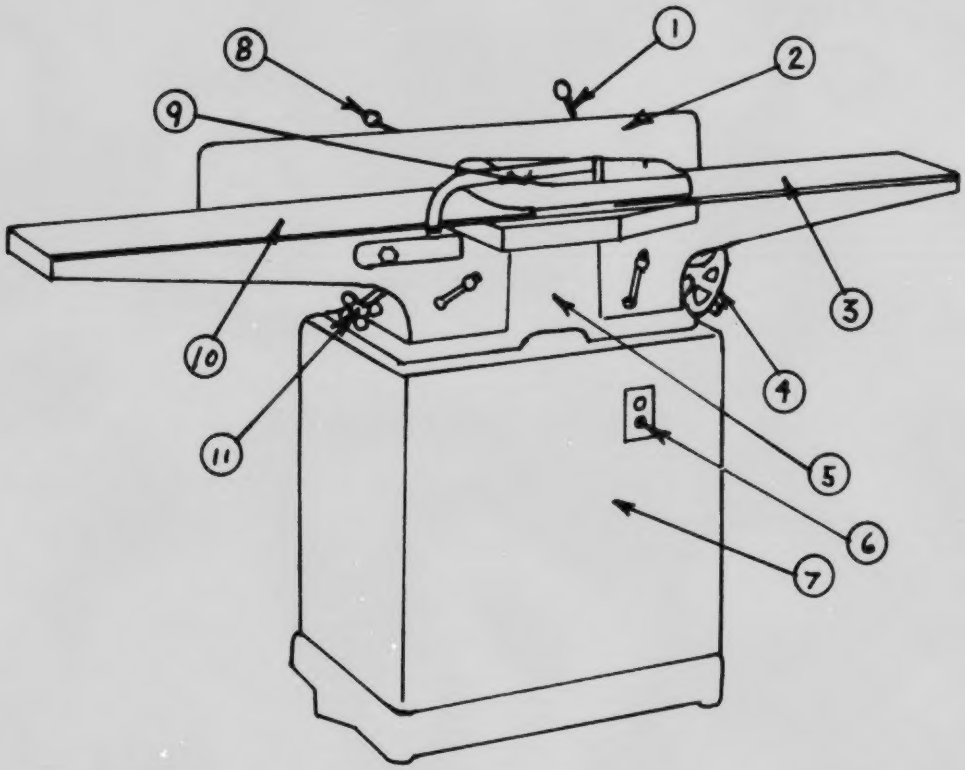
10. Use a push stick or push block when the hands would pass over or within two inches of the cutter head.

11. Make several light cuts (1/6" to 1/8") instead of one heavy cut (1/2").

12. Remember that the absolute minimum length of material that may be joined is twice the size of the knives-- 6" jointer, 12"; 8" jointer, 16 ".

13. Do not adjust or move the rear or feed table without permission.

JOINTER



1 Fence tilting level
2 Fence
3 In feed table
4 In feed table adjusting wheel
5 Base
6 Switch
7 Stand
8 Fence adjustment level
9 Front guard
10 Out feed table
11 Out feed table adjusting wheel

JOINTER SAFETY QUIZ

NAME ________________________

CLASS ________________________

DATE ____________ GRADE ______

True-False

T F 1. The size of the jointer is determined by the length of its knives.

T F 2. A stock less than ten inches in length should not be joined on the power jointer.

T F 3. The depth of the cut is adjusted by the rear table.

T F 4. A push block should not be used when jointing the face.

T F 5. The jointer fence should be checked with a T-level.

T F 6. Boards that are 1/4 inch thick cannot be jointed on the jointer.

T F 7. When jointing the edge, the rough face goes against the fence.

T F 8. The only time that the front guard should be removed is when one is cutting a rabbit.

T F 9. The outfeed table is level with the cutter knives.

Multiple Choice:

_______10. Which of the following is not a part of the jointer?

A. base.
B. infeed table.
C. miter gauge.
D. fence.

Multiple Choice:

_____ 11. The size of the jointer is determined by:

A. the length of the knives.
B. the length of the table.
C. the number of knives.
D. none of these.

_____ 12. The depth of cut is adjusted by:

A. the fence.
B. the rear table.
C. the guard.
D. the front table.

_____ 13. Which of these operations cannot be done on the jointer?

A. cutting a level.
B. cutting a rabbit.
C. cutting a dado.
D. surfacing a board.

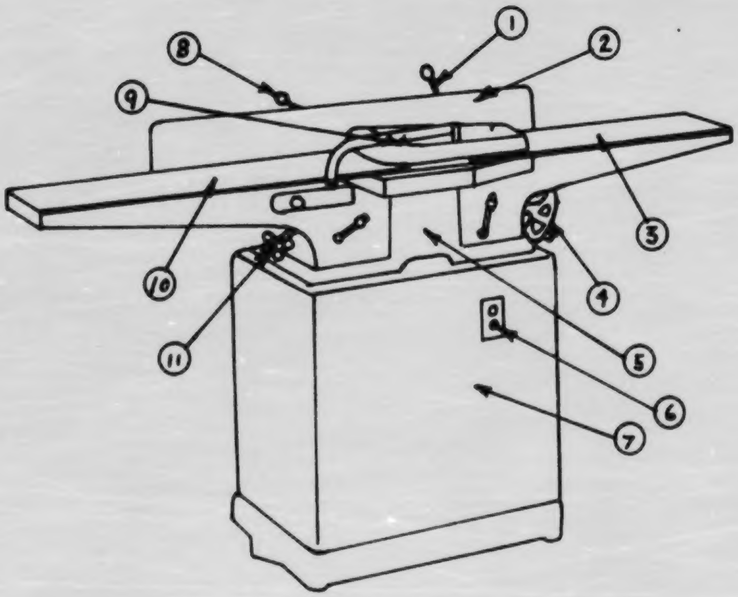
_____ 14. The jointer must have, as a safety device:

A. front guard.
B. rear guard.
C. locking fence.
D. all of the above.

_____ 15. The jointer takes the place of:

A. a rip saw.
B. a file.
C. a hand plane.
D. a tri-square.

16. Identify the parts of the jointer shown in the following drawing:



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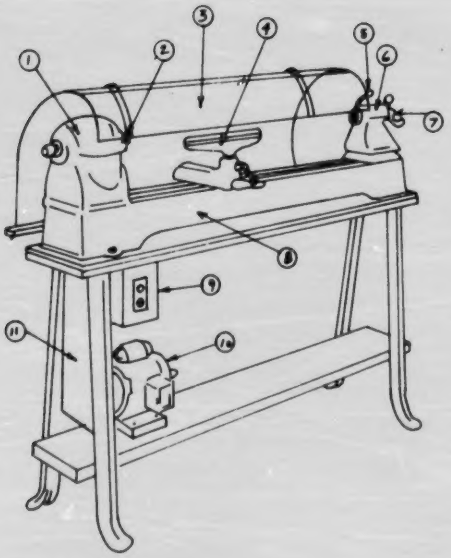
Signed: ______________________
Pupil

Date ______________________

____
Teacher

LATHE



1. HEAD STOCK
2. INDEXING PIN
3. SAFETY SHIELD
4. TOOL REST
5. TAIL STOCK SPINDLE CLAMP
6. TAIL STOCK
7. TAIL STOCK HANDLE
8. LATHE BED
9. SWITCH
10. MOTOR
11. BELT GUARD COVER

1. Cutting heads on wood-turning lathes, whether rotating or not, shall be covered as completely as possible by hoods or shields, which shall be hinged to the machine so they can be thrown back for making adjustments. (OSHA)

2. Lathes used for turning long pieces of wood stock, held only between two centers, shall be equipped with long, curved guards extending over the tops of the lathes in order to prevent the work piece being thrown out of the machine if the guards should become loose. (OSHA)

3. The teacher's permission must be obtained before using the lathe.

4. One should never use stock that is cracked or has knots, checks, or poor glue joints.

5. All glued material must be properly cured and dry. It MUST SET 24 HOURS BEFORE IT IS USED IN THE LATHE.

6. Before turning on the power, the operator should rotate the stock by hand to check that it is free. He/she should stand to one side when the power is first turned on.

7. Rough stock is to be turned at the slowest speed on the lathe.

8. One should increase and decrease the speed gradually because centrifugal force may break the wood, or cause the material to come off the spindle.

9. The tool rest should be adjusted as close to the material as possible, when starting; and should be frequently adjusted as the turning progresses.

10. The lathe should be started at its lowest speed.

11. The turning tool should be held firmly with both hands while cutting.

12. The lathe must be stopped before using the calipers to determine the diameter of the stock. The tool rest should not be adjusted until the lathe has stopped.

13. All large diameter stock is turned at the slowest lathe speed.

14. The tool rest and tool rest post should be removed when sanding, finishing, or polishing. Abrasive paper should not be wrapped around the hands or fingers for sanding.

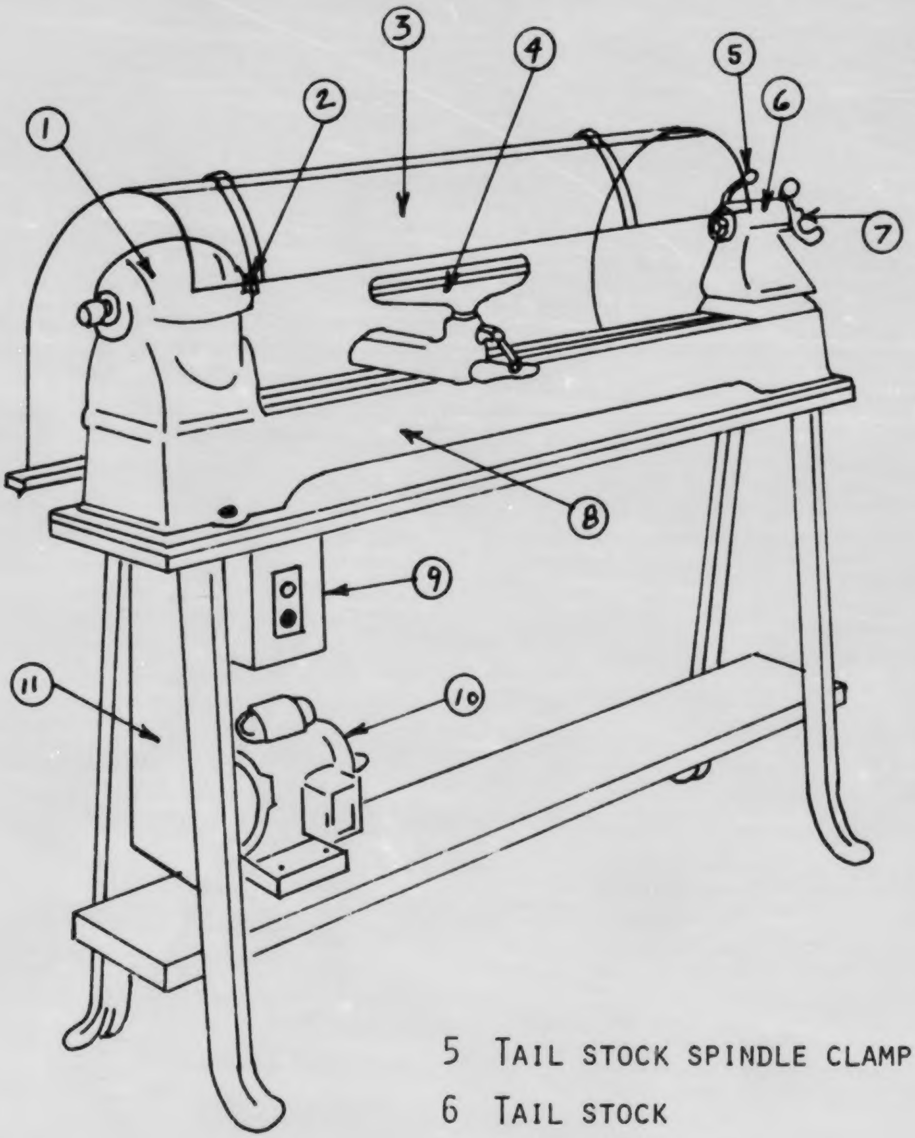
15. The work should be supported with a steady rest when cutting small diameters that are a minimum of 12 inches long.

16. Faceplate work must be securely screwed to the faceplate before it is turned. Great care must be taken when turning to avoid cutting too deeply and striking screws.

17. Faceplate work must be cut to a circular shape on the band saw before turning.

18. The machine and the area around the machine must be cleaned up when work on the lathe is completed.

LATHE



1	HEAD STOCK
2	INDEXING PIN
3	SAFETY SHIELD
4	TOOL REST
5	TAIL STOCK SPINDLE CLAMP
6	TAIL STOCK
7	TAIL STOCK HANDLE
8	LATHE BED
9	SWITCH
10	MOTOR
11	BELT GUARD COVER

LATHE SAFETY QUIZ

NAME______________________________

CLASS______________________________

DATE____________GRADE____________

True-False:

T F 1. The speed of the machine is determined by the size, shape, and kind of material being used.

T F 2. The space between the tool rest and the work should be 1/4 to 1/2 inch.

T F 3. Since the lathe is equipped with a safety shield, it is not necessary to wear safety glasses.

T F 4. Lathe tools should not be used unless they are very sharp.

T F 5. When sanding, it is permissible to feel the smoothness while the lathe is running.

T F 6. The tool rest and tool post should be removed when sanding.

T F 7. Cutting tools must be held tightly and firmly against the tool rest.

T F 8. Since the safety shield covers the spinning of the work loose clothing and long hair are not any problem.

T F 9. When starting to turn on a large block, it is necessary to start at the slowest speed possible.

T F 10. It is unsafe to turn work that is lopsided or out of balance.

T F 11. Prior to starting the lathe, one should turn the work one complete revolution by hand.

T F 12. Material that has been glued and clamped can be used after one hour of drying.

Multiple Choice:

_____ 13. All adjustments on the lathe should be made:

A. after the initial cuts are made.
B. with the teacher present.
C. while the machine is at a dead stop.
D. while the machine is slowly turning.

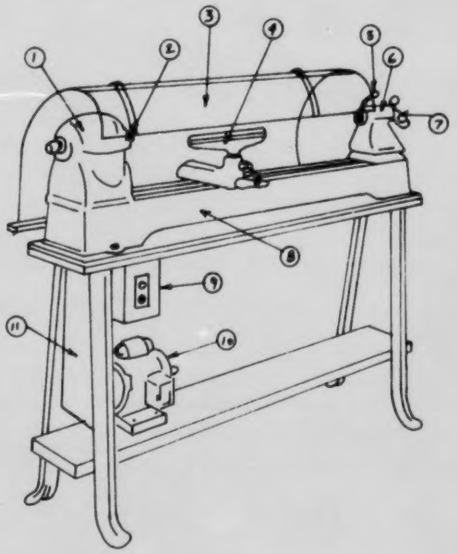
_____ 14. For a beginning operation, one should start the lathe at:

A. a speed of 5,000 rpm.
B. a medium speed.
C. the highest speed.
D. the slowest speed.

_____ 15. The turning tool should be held:

A. firmly against the tool rest.
B. with one hand.
C. only at the start.
D. tucked under the arm.

16. Give the correct names of the lathe parts indicated in drawing:



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Signed ______________________________
Pupil

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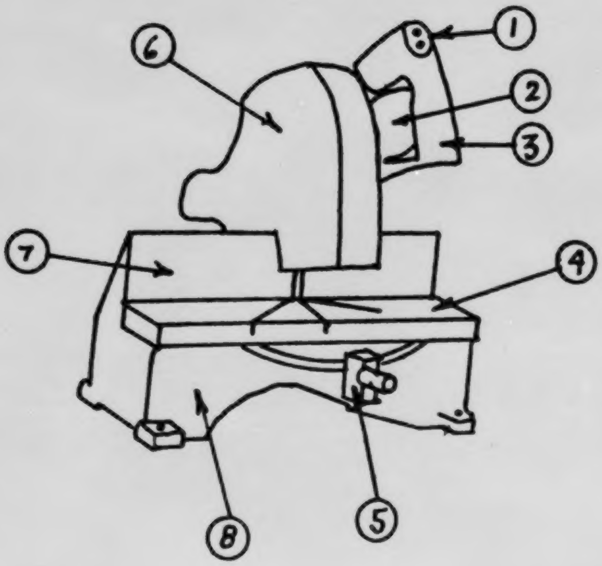
Teacher

Date ________________________

MITER BOX SAW

(MOTORIZED)



1. SWITCH
2. MOTOR
3. OPERATING HANDLE
4. TABLE
5. MITER GAUGE
6. BLADE GUARD
7. FENCE
8. BASE

1. Each swing cutoff saw shall be provided with a hood that will completely enclose the upper half of the saw, the arbor end, and the point of operation at all positions of the saw. Its hood shall be so designed that it will automatically cover the lower portion of the blade, regardless of the position of the saw. (OSHA)

2. A pupil must get the teacher's permission to use the saw and the teacher must check the setup before it is used.

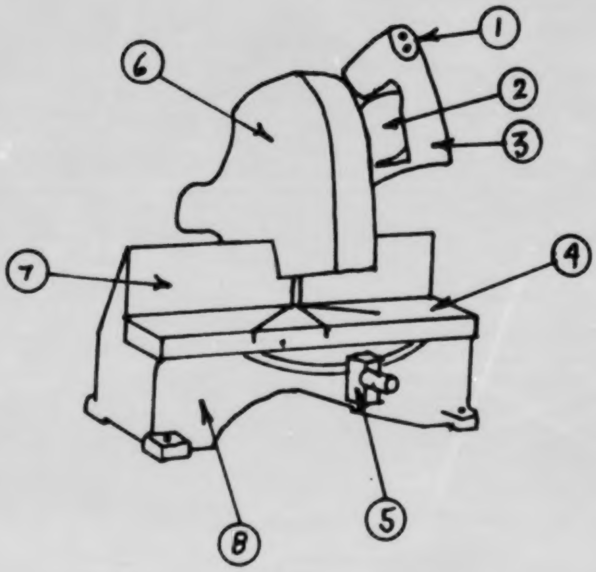
3. The material to be cut should be held firmly against both the table and the fence.

4. The material must not be held by hand. Some type of clamp should be used.

5. The hands should never come within six inches of the cutting blade.

6. The area should be cleaned up after using the saw.

MITER BOX SAW
(MOTORIZED)



1 SWITCH
2 MOTOR
3 OPERATING HANDLE
4 TABLE
5 MITER GAUGE
6 BLADE GUARD
7 FENCE
8 BASE

MITER BOX SAFETY QUIZ

NAME____________________________

CLASS____________________________

DATE__________GRADE______________

True-False:

T F 1. The teacher should check the setups before a pupil turns on the machine.

T F 2. It is usually best to work in pairs on this piece of equipment.

T F 3. It is all right to use stop blocks on a motorized miter box saw.

T F 4. One does not need to wear safety glasses when using this saw because it takes just a minute to complete an operation with the saw.

T F 5. It is easier to see what one is doing if he/she removes the guards on the side of the saw blade.

Multiple Choice:

_____ 6. When operating the motorized miter box:

A. remove tie, rings, watch, and other jewelry, and roll up the sleeves.
B. always wear safety glasses or face shield.
C. keep the guards in place and in use at all times.
D. all of the above.

_____ 7. When making any adjustments:

A. disconnect the power.
B. unlock the pivot arm.
C. apply the brake.
D. lock the motor in an up position.

_____8. Work should be held firmly against:

A. the table.
B. the fence.
C. the fence and table.
D. the pivot arm.

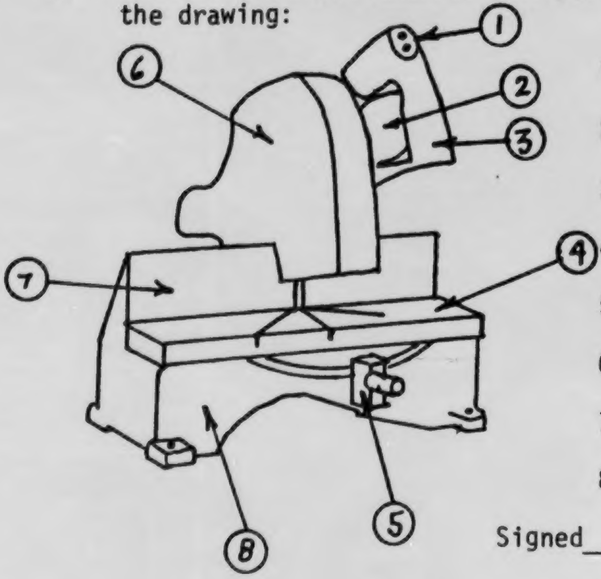
_____9. When a cut has been made:

A. release the trigger and remove the scrap from the table.
B. release the trigger and lock the motor in up position.
C. release the trigger and apply the brake.
D. release the trigger and move to the next operation.

____10. When ready to cut one should wait for the motor on the miter box:

A. to come up to half speed.
B. to come up to full speed.
C. to reach a speed for the type of job to be done.
D. to reach any speed.

11. Give the correct names of the parts of the saw indicated on the drawing:



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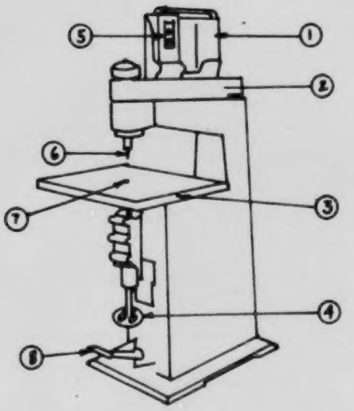
PIN ROUTER



1. MOTOR
2. BELT GUARD
3. TABLE
4. PIN ADJUSTMENT WHEEL
5. SWITCH
6. ROUTER CUTTER
7. GUIDE PIN
8. OPERATING FOOT PEDAL

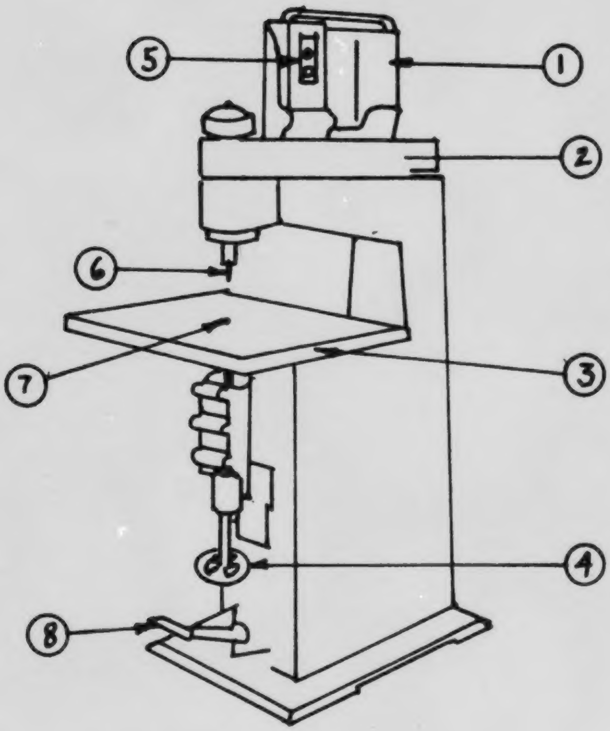
1. All OSHA safety rules regarding the use of guards and machine construction must be met. (Refer to "Machine Guarding" unit at the beginning of this section.)

2. The guard must be in place before the power is turned on.

3. The stock must always be fed against the rotation of the cutter. If not, the wood will be thrown out of the operator's hands.

4. The table should always be lowered to the bottom-most position before lowering the head. Failure to do so may cause the router bit to be driven into the table.

PIN ROUTER



1 Motor
2 Belt guard
3 Table
4 Pin adjustment wheel
5 Switch
6 Router cutter
7 Guide pin
8 Operating foot pedal

PIN ROUTER SAFETY QUIZ

NAME ______________________________

CLASS _____________________________

DATE _________________ GRADE ______

True-False:

T F 1. Since the pin coming through the table guides the material, guards are not necessary.

T F 2. Stock must always be fed against the rotation of the cutter.

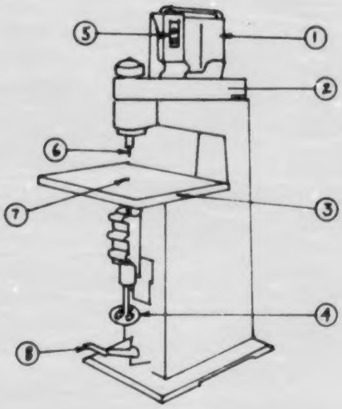
T F 3. The position of the table is not as important as the position router bit.

T F 4. The teacher must check every setup used on this machine.

T F 5. Safety glasses are a must on this machine because of the cuttings being thrown.

T F 6. It is not possible to drive the router bit into the table.

7. Name all the parts indicated on the drawing of the pin router:



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Signed: ______________________________
Pupil

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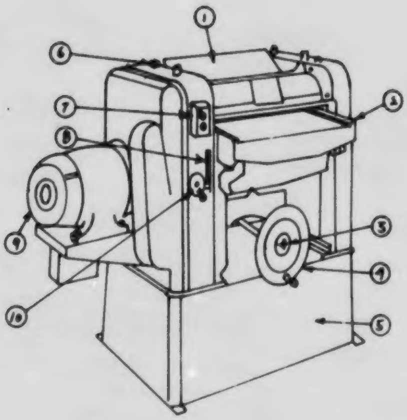
Teacher

Date ______________________________

PLANER (SURFACER)



1. CHIP GUARD
2. TABLE
3. HANDWHEEL LOCK
4. ELEVATING HANDWHEEL
5. BASE
6. FEED ROLL ADJUSTMENTS
7. SWITCH
8. DEPTH OF CUT GAUGE
9. MOTOR
10. VARIABLE SPEED FEED ROLL

1. The cutting heads must be guarded with a metal guard which has a minimum thickness of 1/16 inch, if made of sheetmetal; or a minimum of 3/16 inch, if made of cast iron. (OSHA)

2. Where an exhaust system is used, the guards shall form a part of the hood and shall be constructed of metal. (OSHA)

3. Feed rolls must be guarded by a hood or suitable guard to prevent the operator's hands from coming in contact with the in-running rolls.

4. The stock should be checked to make sure it is clean and free from loose knots and other defects.

5. Never surface stock smaller than 10" or distance between rollers plus 2 inches.

6. Loose clothing and dangling jewelry present safety hazards. One should avoid wearing them when operating the planer.

7. One should always stand to one side of the planer when it is in use.

8. Adjustments should be made only when the machine is at a dead stop.

9. The board to be planed must have at least one true surface.

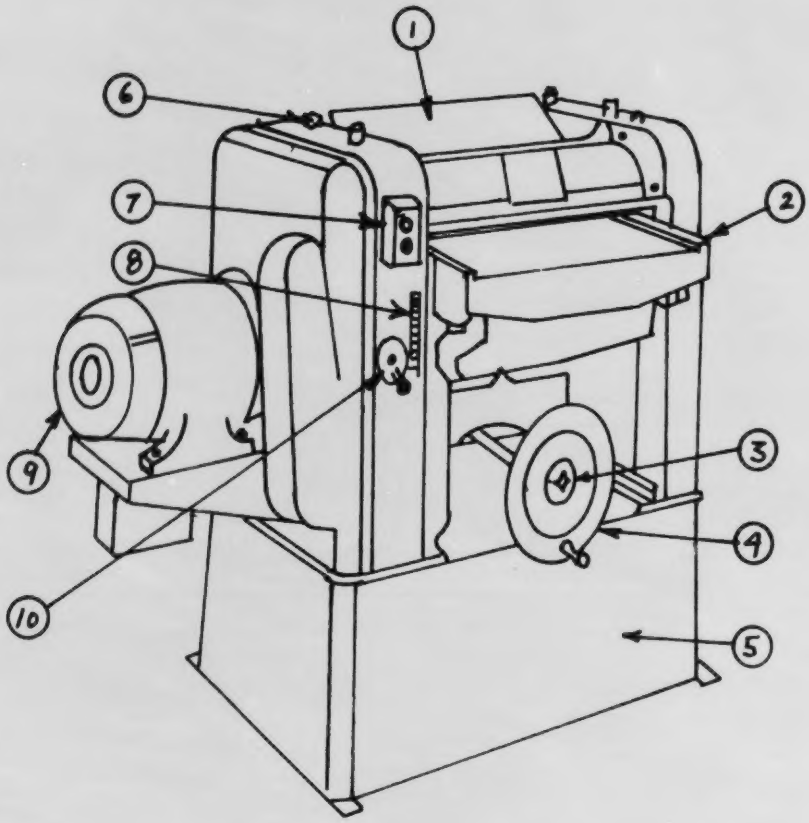
10. The cuts on wide boards should be limited to 1/16 inch or less.

11. Thin stock can be planed by placing it on top of a thick surfaced board.

12. Only one board should be planed at any one time.

13. The teacher's permission should be obtained before operating the planer.

PLANER (SURFACER)



1 Chip guard

2 Table

3 Handwheel lock

4 Elevating handwheel

5 Base

6 Feed roll adjustments

7 Switch

8 Depth of cut gauge

9 Motor

10 Variable speed feed roll

PLANER (SURFACER) SAFETY QUIZ

NAME______________________________

CLASS______________________________

DATE______________GRADE____________

True-False:

T F 1. Wood with loose knots is dangerous and should not be run through the planer.

T F 2. The shortest board that should be run through the machine should be two inches longer than the distance between the rollers.

T F 3. Grain direction is unimportant when surfacing stock.

T F 4. One can get one's finger pinched between the board and the table when running short boards.

T F 5. The operator should stand to one side of the stock being surfaced.

T F 6. Painted or used wood may be cleaned up on the planer without any problems.

T F 7. The planer will straighten out a curved or twisted board.

T F 8. Glued joints must be scraped off before being surfaced.

T F 9. The operator should look into the machine to check the depth of the cut on the material.

T F 10. Chips should be removed even if the machine is running.

Multiple Choice:

_____ 11. If the material jams or the planer fails to work properly, one should:

A. adjust the pressure of the feed rollers.
B. readjust the depth of the cut.
C. push harder on the wood.
D. turn off the power and call the teacher.

_____ 12. In planing most stock it is not necessary to remove more than:

A. three turns on the adjustment wheel.
B. 1/8 inch of stock per cut.
C. 1/16 inch of stock per cut.
D. any amount is all right.

_____ 13. Wood to be surfaced down to 3/8 inch thickness or less should be:

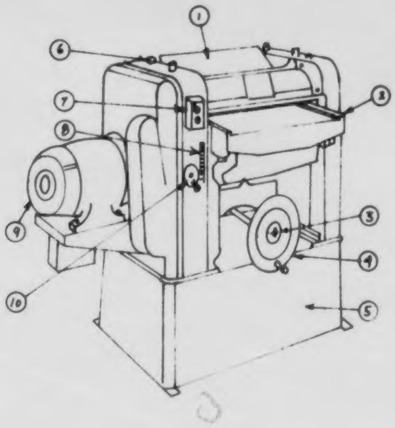
A. surfaced on the edges first.
B. placed on top of a thicker board and run through the planer.
C. fed into the machine behind a piece of like thickness.
D. placed beside a piece of like thickness and run through the machine.

_____ 14. One which side of the board does the planer cut?

A. bottom,
B. top,
C. both sides at the same time.

15. Name the parts of the planer indicated in the following drawing:

1. ____________________
2. ____________________
3. ____________________
4. ____________________
5. ____________________
6. ____________________
7. ____________________
8. ____________________
9. ____________________
10. ____________________

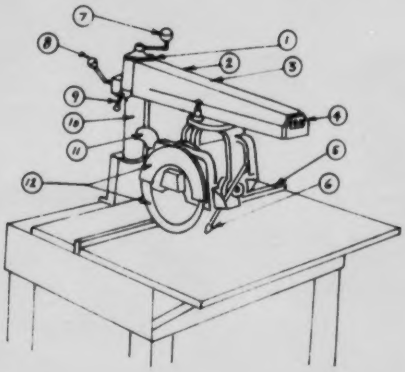


Signed____________________
Pupil

____
Teacher

Date____________________

RADIAL SAW



1. MITER SCALE
2. RETURN SPRING
3. ARM
4. SWITCH
5. FENCE
6. KICKBACK GUARD
7. ELEVATING HANDLE
8. ARM CLAMP HANDLE
9. MITER LATCH
10. COLUMN
11. SAW DUST SPOUT
12. SELF-ADJUSTING BLADE GUARDS

1. The upper hood shall completely enclose the upper portion of the blade down to a point that will include the end of the saw arbor. (OSHA)

2. Each radial saw shall be provided with non-kickback fingers or dogs. (OSHA)

3. An adjustable stop shall be provided to prevent the forward travel of the blade beyond the position necessary to complete the cut in repetitive operations. (OSHA)

4. Radial saws are required to be installed in such a manner that the front end of the unit will be slightly higher than the rear so the CUTTING LOAD WILL RETURN GENTLY to the starting position when released by the operator. A return spring should be attached to the post and the motor which will aid in the return. (OSHA)

5. The blade should be set at a depth to cut not more than 1/8 inch below the surface of the table.

6. The operator should check to make sure the saw is back against the stop before turning on the power. The blade must not be touching any wood when the power is turned on.

7. The material to be cut must be held firmly against the table and fence.

8. The direction of rotation of this saw blade causes it to climb into the stock and stall. To avoid this, feed the saw slowly and smoothly.

9. Hands and fingers should be kept clear of the path of the saw blade at all times (at least 6").

10. The motor should reach full speed before beginning to cut.

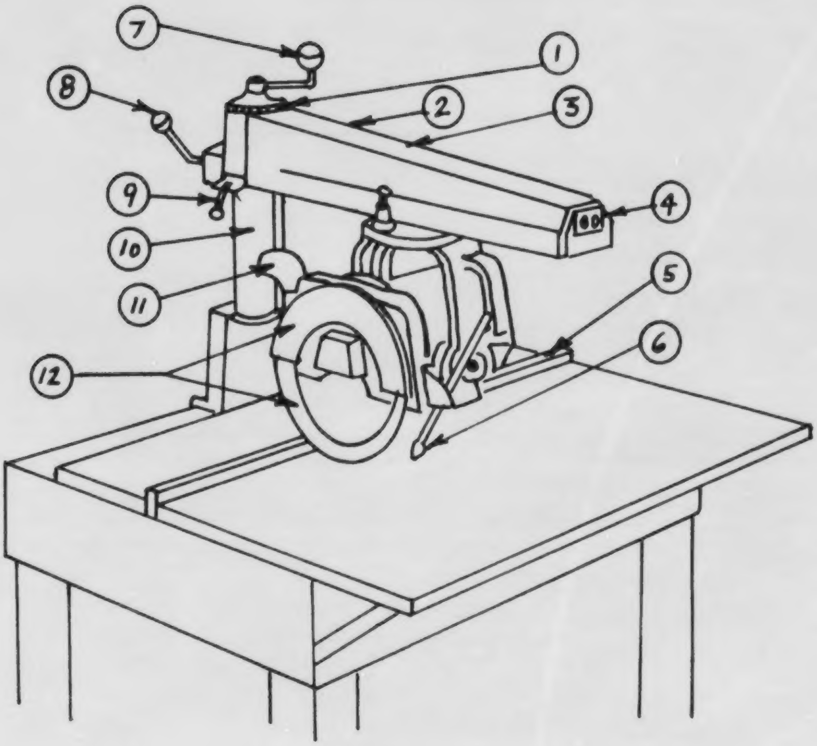
11. The table should always be cleaned of scraps and dust before, during, and after using the saw.

12. All special setups (except for straight cut-off work) must be checked by the teacher.

13. The operator should make sure the saw blade has stopped rotating before making any adjustments on the machine.

14. The teacher's permission must be obtained before one attempts to use the machine.

RADIAL SAW



1 MITER SCALE
2 RETURN SPRING
3 ARM
4 SWITCH
5 FENCE
6 KICKBACK GUARD

7 ELEVATING HANDLE
8 ARM CLAMP HANDLE
9 MITER LATCH
10 COLUMN
11 SAW DUST SPOUT
12 SELF-ADJUSTING BLADE GUARDS

RADIAL SAW SAFETY QUIZ

NAME ______________________________

CLASS ______________________________

DATE _______________ GRADE _________

True-False

T F 1. The saw blade should be set one half inch below the table surface.

T F 2. This saw must be set so it will automatically return to the rear of the machine.

T F 3. All adjustments and stops should be made before starting the saw.

T F 4. On thick material it is permissible to remove the guards on the bottom of the blade so one can see.

T F 5. The operator should stand by until the blade stops rotating after he/she has pushed the "off" switch.

T F 6. When one moves the arm to make miter cuts he/she must first raise the blade.

T F 7. This saw can be the most dangerous machine in the shop because of its many uses.

T F 8. Since the blade cuts into the material, it is not necessary to hold it against the fence.

T F 9. Curved or warped wood is not too difficult to cut on this saw.

T F 10. The most dangerous operation on this saw is ripping wood.

T F 11. The teacher's permission to operate this machine is needed only after the pupil makes a special setup.

T F 12. When crosscutting, feed the saw through the stock only as fast as it will cut.

Multiple Choice:

_____13. The radial saw can be most safely used for:

A. crosscutting.
B. ripping.
C. cutting dados.
D. curved cuts.

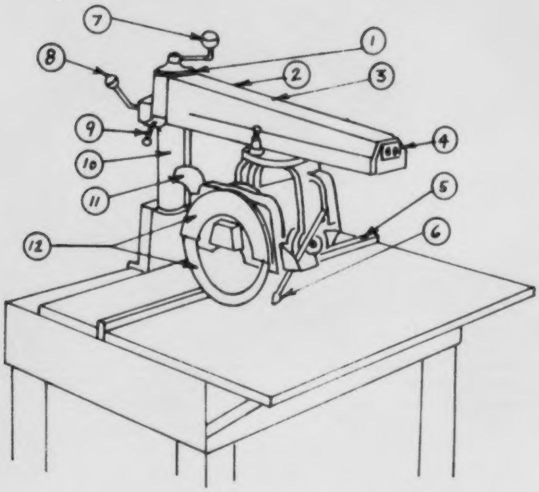
_____14. Pushing a piece of wood into a coasting blade may:

A. damage the machine.
B. ruin the blade.
C. result in a serious accident.
D. do all of the above.

_____15. One should remember that the radial arm saw pulls itself into the work, therefore:

A. hardwood should never be cut.
B. assistance from a helper is necessary.
C. it is necessary to hold back on the handle to prevent the saw from choking.
D. none of the above are true.

16. Identify the parts of the radial saw indicated in the drawing: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1 ______________________________

2 ______________________________

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4 ______________________________

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7. ______________________________

8. ______________________________

9. ______________________________

10. ______________________________

11. ______________________________

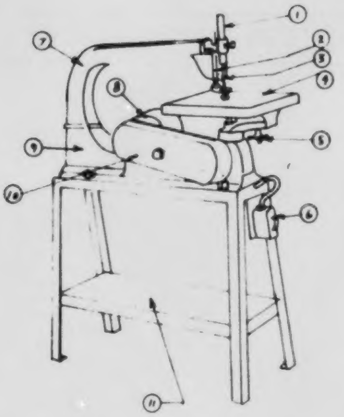
12. ______________________________

Signed ______________________________
Pupil

____
Date

____
Teacher

SCROLL (JIG) SAW



1. TENSION SLEEVE
2. HOLD-DOWN GUARD
3. UPPER CHUCK
4. TABLE
5. TABLE ADJUSTMENT KNOB
6. SWITCH
7. OVER ARM
8. MOTOR
9. BASE
10. BELT AND PULLEY GUARD
11. STAND

1. Hinged saw tables shall be so constructed that the table can be firmly secured in any position and in true alignment with the saw. (OSHA)

2. All belts, pulleys, gears, shafts, and moving parts shall be guarded in accordance with the specific requirements in the OSHA Handbook. (OSHA)

3. The teacher's permission must be obtained before using machine.

4. The operator should select a blade to suit the thickness of the wood and the size of the curves to be cut.

5. The blade should first be tightened securely in the lower chuck, then in the upper chuck.

6. The blade guide should be adjusted in line with the blade to support it while cutting.

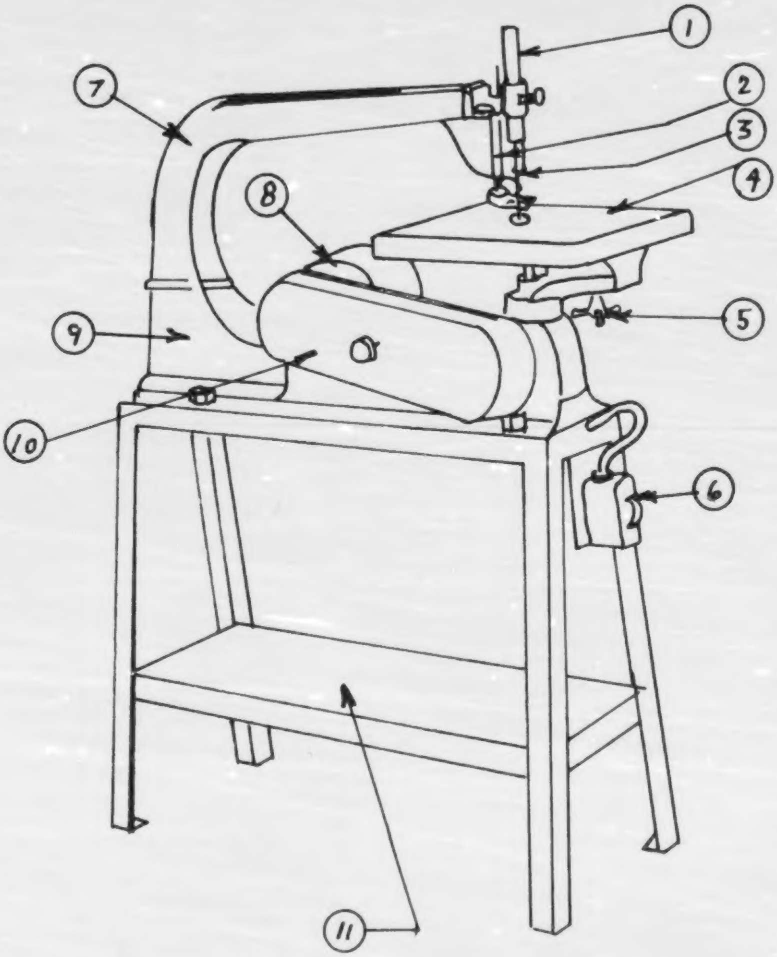
7. The operator should lower the hold-down or pressure foot to press lightly on the surface of the stock being cut.

8. One can check the tension of the blade by turning the motor by hand. If knocking is heard, stop the machine and readjust the tension.

9. The stock should be held firmly while feeding it at a moderate rate of speed.

10. Fingers and hands must be kept away from the path of the blade.
11. Large curves should be cut first, then small details.
12. One should not make sudden turns or sharp turns.
13. Only stock with a flat surface should be cut.
14. One should turn off the machine and wait until it has stopped moving before removing scraps or leaving the machine.

SCROLL (JIG) SAW



1 Tension sleeve
2 Hold-down guard
3 Upper chuck
4 Table
5 Table adjustment knob
6 Switch
7 Over arm
8 Motor
9 Base
10 Belt and pulley guard
11 Stand

SCROLL (JIG) SAW SAFETY QUIZ

NAME ____________________

CLASS ____________________

DATE ____________ GRADE ____

True-False:

T F 1. The scroll saw can cut as small as 90^{0} corners.

T F 2. The pulley should be turned by hand to be sure the blade functions correctly before turning on the machine.

T F 3. The hold-down guard must be in place to keep the material from being pulled up with the upward stroke.

T F 4. The blade should be installed with the teeth pointing up.

T F 5. The tension from the upper head pulls the blade back up after the motor pulls it down.

T F 6. Since the scroll saw is the easiest saw to operate, it is possible to talk to a friend while operating it.

T F 7. Safety glasses must be worn when operating the scroll saw.

T F 8. The pulley belt must be covered at all times when the saw is in use.

Multiple Choice:

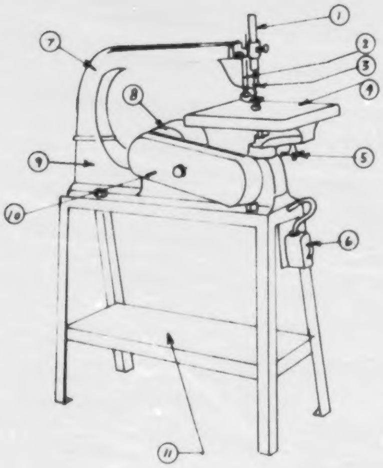
______ 9. One's fingers should never be permitted to get:

A. directly in line with the blade.
B. close to the tension sleeve.
C. near the over arm.

______ 10. All scraps and cutoff pieces should be removed only:

A. when the machine is at a dead stop.
B. at the end of the period.
C. when installing a new blade.

11. Identify the parts of a scroll saw indicated in the drawing: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10 ____________________

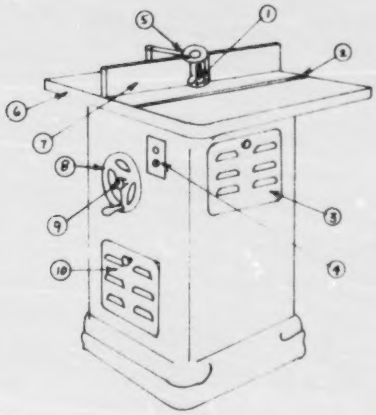
11 ____________________

Signed ____________________
Pupil

____
Date

____
Teacher

SHAPER



1. SPINDLE
2. MITER GAUGE GROOVE
3. SPINDLE ACCESS PANEL
4. SWITCH
5. SPINDLE GUARD
6. TABLE
7. ADJUSTABLE FENCE
8. SPINDLE RAISING WHEEL
9. HAND WHEEL LOCK
10. CLEANOUT DOOR

1. Wood shapers that are not automatically fed are required to have the cutting head enclosed with a cage or adjustable guard so designed as to keep the operator's hand away from the cutting edge. (OSHA)

2. The pupil must obtain the teacher's permission and have him/her check all setups used on the machine.

3. The machine should be setup so that the unused portion of the cutter blade will be below the table.

4. The setup should be made so the cutting will be on the bottom side of the board to eliminate cutter exposure.

5. When installing cutters one should make sure an approved lock washer and spindle nut are used to hold the cutter on the spindle.

6. The operator should use all guards, hold-down devices, and feather boards provided for the machine. All adjustments should be made when the machine is at a dead stop.

7. All wrenches or other tools used in setting up the shaper should be removed from the table before turning on the power.

8. Only new stock should be cut. One should make sure it has a straight edge and is free of knots, wind, splits, twists, and curly grain. Any of these defects are a source of danger.

9. The operator must determine the direction of rotation of the cutter and check the direction of the feeding material. (CHECK WITH THE TEACHER.)

10. The operator must never run an end grain of boards less than eight inches in width, without using a sliding guide such as a miter gauge.

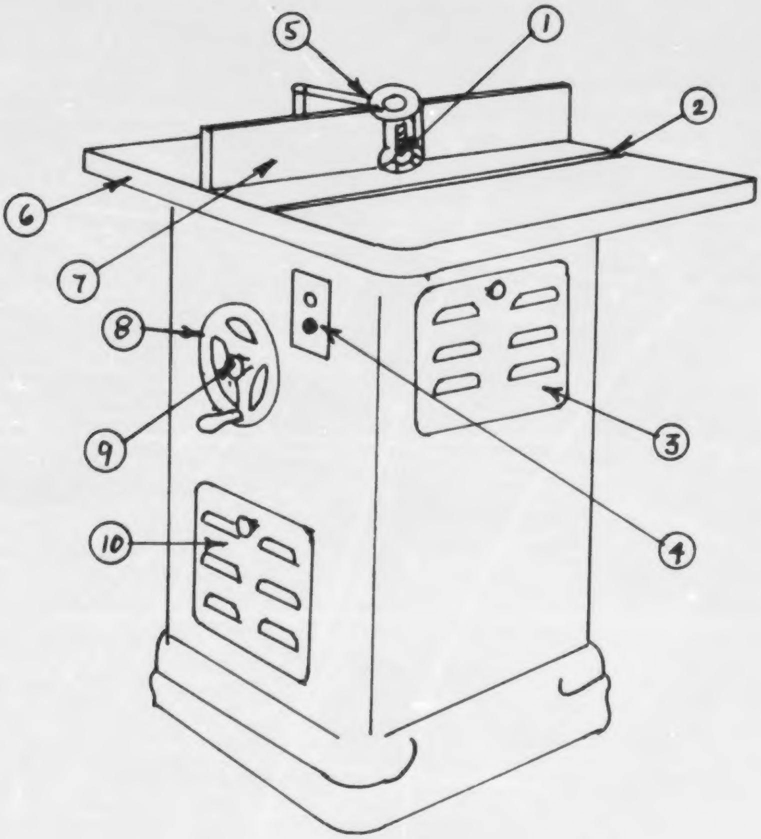
11. A push stick or pusher should be used, whenever possible.

12. When one is shaping an edge, the stock must be at least two inches wide and ten inches long.

13. The fingers should never be allowed to come closer than six inches to the cutting head.

14. A trial cut should be made on an extra piece of material that is the same as the project material.

SHAPER



1	SPINDLE	6	TABLE
2	MITER GAUGE GROOVE	7	ADJUSTABLE FENCE
3	SPINDLE ACCESS PANEL	8	SPINDLE RAISING WHEEL
4	SWITCH	9	HAND WHEEL LOCK
5	SPINDLE GUARD	10	CLEANOUT DOOR

SHAPER SAFETY QUIZ

NAME______________________________

CLASS______________________________

DATE_______________GRADE__________

True-False:

T F 1. When setting the shaper the operator should be sure the unraised portion of the cutter is below the surface of the table.

T F 2. It is best to set up the shaper to cut on top of the material so one can see what is happening.

T F 3. It is not necessary to check the spindle, spindle sleeves, or spindle nut before starting the machine.

T F 4. It is never wise to run the end grain of boards less than eight inches in width without using a guide.

T F 5. Fingers should always be kept at least six inches away from the cutter.

T F 6. The direction of rotation of the cutter determines the direction of the feeding material.

T F 7. It is better to adjust the height of the cutter when the machine is running.

T F 8. Whenever possible, one should use a push stick or push block.

T F 9. Wrenches used to tighten the spindle should be kept on the back of the table behind the fence.

T F 10. Only new stock that is free of knots, splints, twists, and curly grain should be cut.

Multiple Choice:

_____ 11. When changing the cutter, one should:

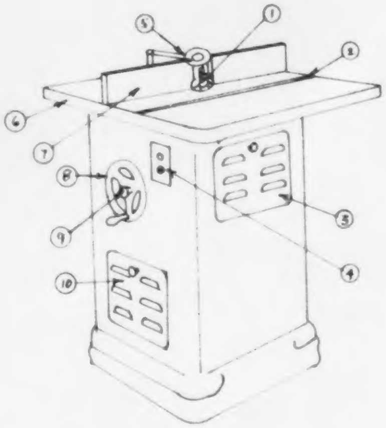
A. use only the tools available.
B. use any wrench to loosen the spindle nut.
C. shut off the main switch, turn the "off and on" switch, to "off," and use the proper wrenches on the spindle nut.

_____ 12. In setting up or using the machine, one:

A. may start right away.
B. may use it if no one else is doing so.
C. may use it if he/she has used it before.
D. may use it after getting the teacher's permission.

13. Give the correct names of the parts indicated in the drawing:

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________
6. ______________________________
7. ______________________________
8. ______________________________
9. ______________________________
10. ______________________________



Signed______________________________
Pupil

Date____________________ ______________________________
Teacher

KEY TO SAFETY TESTS

BAND SAW

1. True
2. False
3. False
4. True
5. True
6. False
7. False
8. True
9. True
10. True
11. B
12. A
13. C
14. D

CIRCULAR TABLE SAW

1. True
2. False
3. True
4. True
5. False
6. False
7. True
8. False
9. True
10. True
11. True
12. False
13. B
14. B
15. D

DRILL PRESS

1. True
2. False
3. False
4. True
5. False
6. True
7. False
8. True
9. True
10. True
11. False
12. B
13. D
14. A
15. D

FINISHING MACHINE

1. False
2. True
3. False
4. True
5. True
6. False
7. True
8. True
9. False
10. False
11. True
12. True
13. D
14. A
15. B

JOINTER

1. True
2. True
3. False
4. False
5. False
6. True
7. False
8. True
9. True
10. D
11. A
12. D
13. C
14. D
15. C

LATHE

1. True
2. False
3. False
4. True
5. False
6. True
7. True
8. False
9. True
10. True
11. True
12. False
13. C
14. D
15. A

MITER BOX SAW (MOTORIZED)

1. True
2. False
3. True
4. False
5. False
6. D
7. A
8. C
9. C
10. B

PIN ROUTER

1. False
2. True
3. False
4. True
5. True
6. False

PLANER (SURFACER)

1. True
2. True
3. False
4. True
5. True
6. False
7. False
8. True
9. False
10. False
11. D
12. C
13. B
14. B

RADIAL SAW

1. False
2. True
3. True
4. False
5. True
6. True
7. True
8. False
9. False
10. True
11. False
12. True
13. A
14. D
15. C

SCROLL SAW

1. False
2. True
3. True
4. False
5. True
6. False
7. True
8. True
9. A
10. A

SHAPER

1. True
2. False
3. False
4. True
5. True
6. True
7. False
8. True
9. False
10. True
11. C
12. D

REFERENCES

Materials were selected and reviewed from the following sources, and in some instances were incorporated in the production of the preceding unit.

1. OSHA - U.S. Department of Labor
2. NIOSH - U.S. Department of Health, Education, and Welfare
3. Ohio State Department of Education--Industrial Arts and Vocational Education Safety Guide
4. Pennsylvania Industrial Arts Association and State Department of Education, State Safety Guide
5. Powermatic Tool Company
6. Pittsburg State University - L. Duane Griffin
7. Rockwell Delta - Rockwell International
8. Shawnee Mission Public Schools - Bill Studyvin
9. Utah State Department of Education, State Safety Guide
10. Washington State Department of Education, Industrial Arts Safety Guide
11. Wichita Public Schools Woodwork Teachers
    (1) Clayton Hall - North High School
    (2) Don Joachims - Curtis Junior High School
    (3) Pete Moriconi - Retired
    (4) Ken Ratcliff - Metro High School
    (5) Chester Shippy - West High School
12. Wyoming State Department of Education

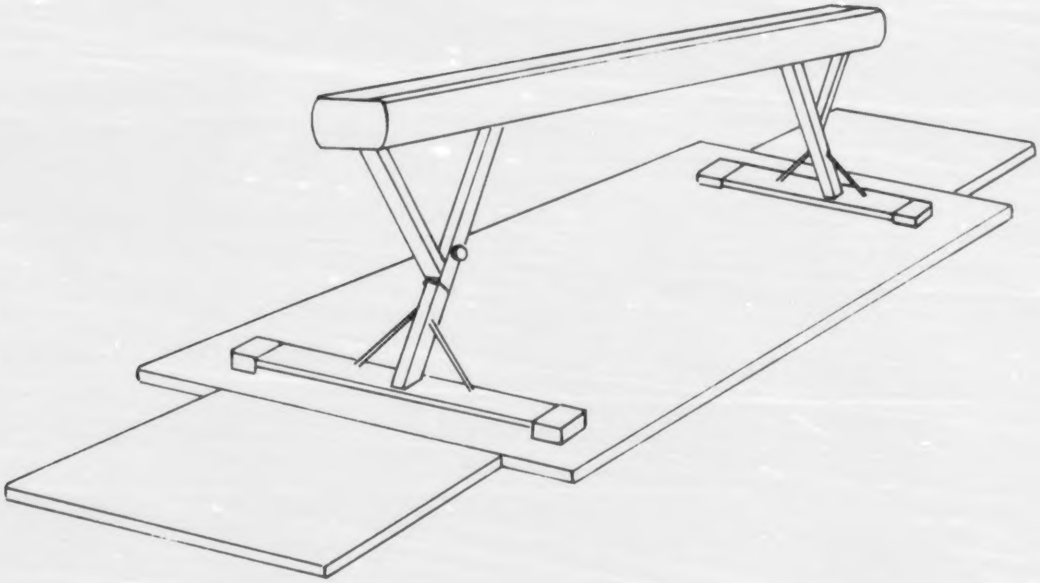
PHYSICAL EDUCATION AND ATHLETIC EQUIPMENT

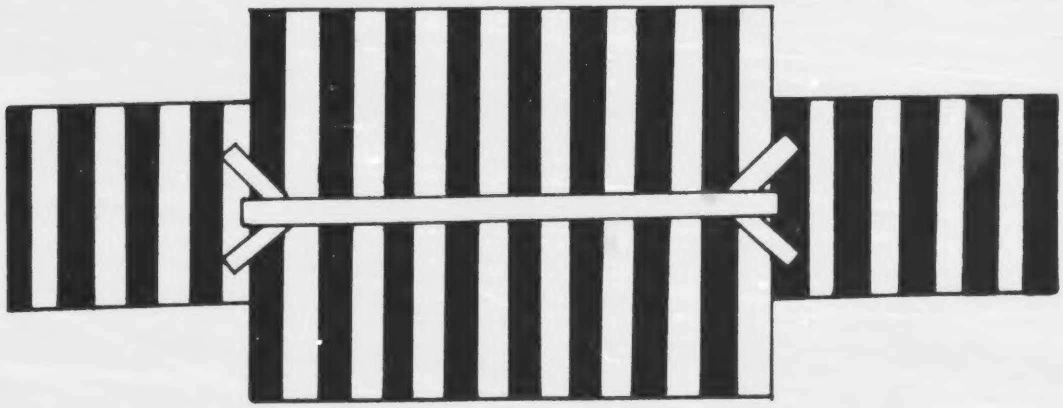
It should never be assumed that pupils are aware of the risk or potential hazard that may accompany the use of any piece of equipment. It is imperative that teachers convey the necessary information to the users.

Communication with participants regarding the proper use of equipment may be accomplished by written or verbal instructions, and by signs or labels placed on the equipment. Warning the users of any possible danger should not be left *solely* to a written sign or label but should be verbally expressed to the participants before they begin their use of the equipment. The supervisor of an activity should be constantly alert to correct anyone that is using the equipment improperly.

Most sports and physical education activities involve some degree of risk or hazard. When it is impossible to *eliminate* the risk or hazard, one must attempt to *minimize* the risk and then take every possible precaution to guard against the hazard. Instructing and warning participants of the potential danger minimizes the risk.

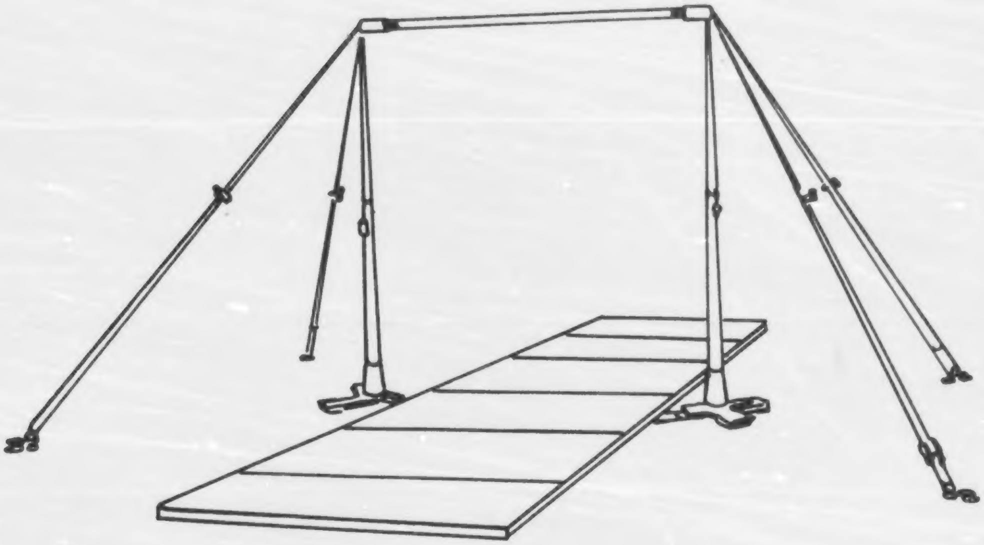
BALANCE BEAM

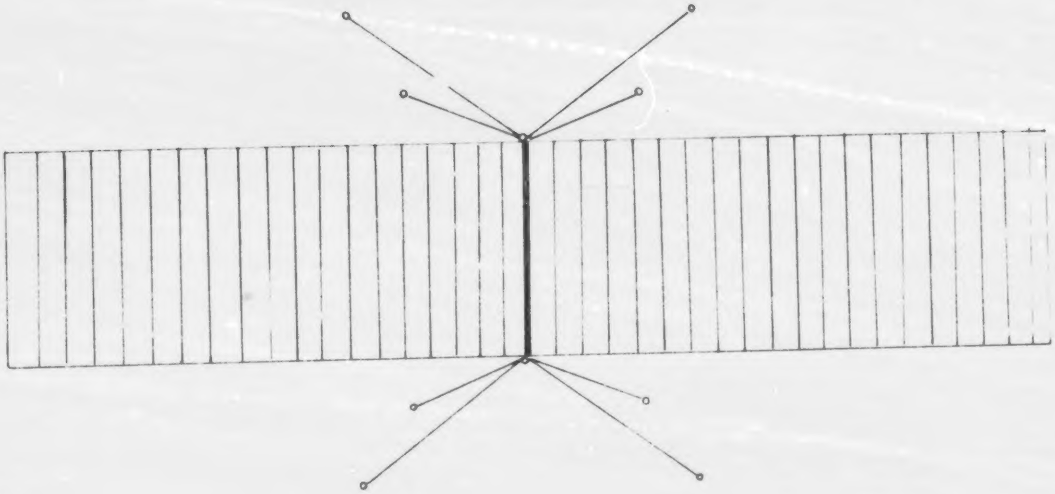




Sides: one 6' x 16' mat for each side of beam
Ends: one 6' x 12' mat on each end
CLEARANCE: 10' on sides, 12" on ends

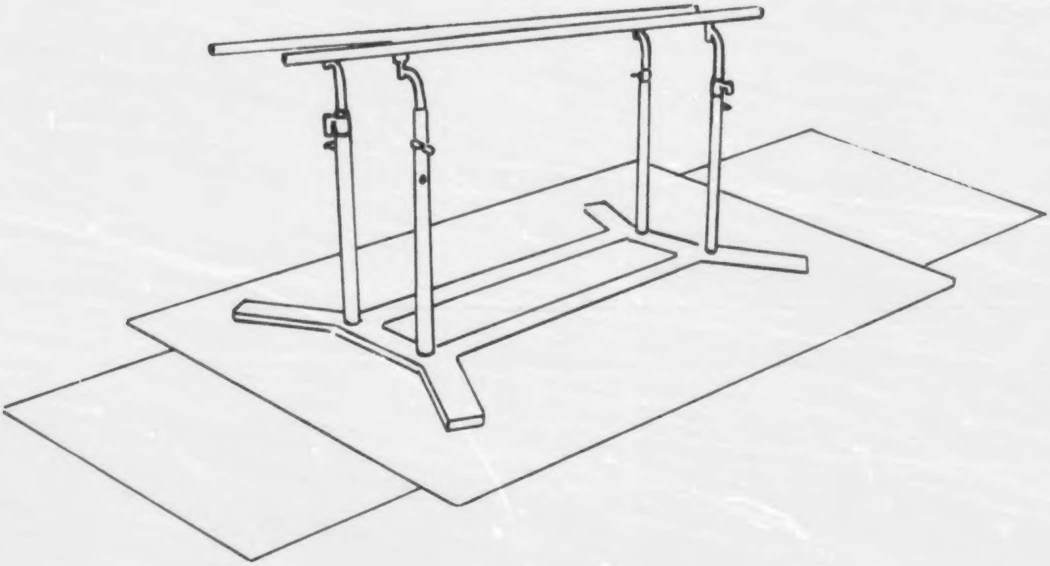
HORIZONTAL BAR

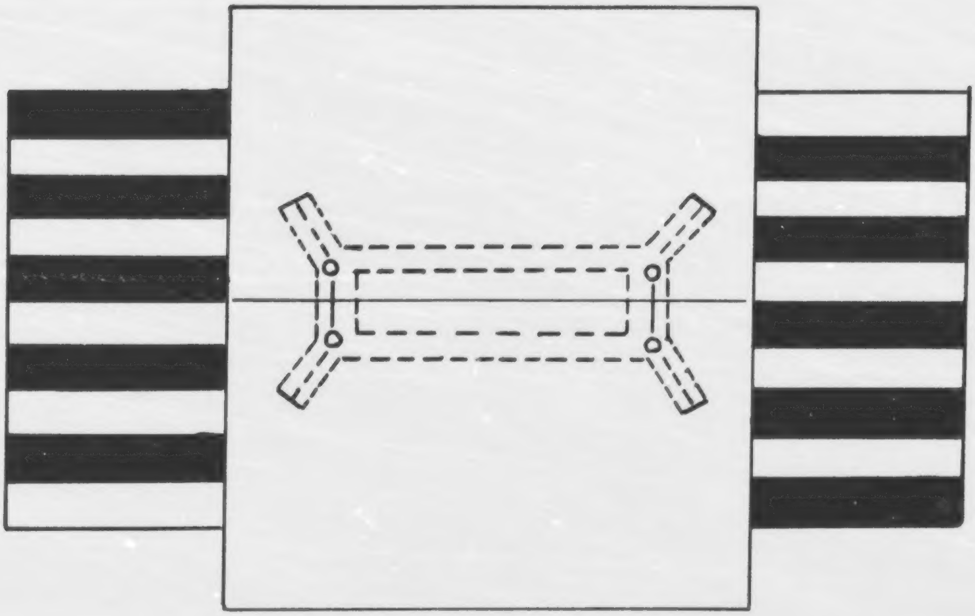




Mat coverage: Four 8' x 10' mats (double the thickness)
CLEARANCE: 28' from bar, 12' from center of bar

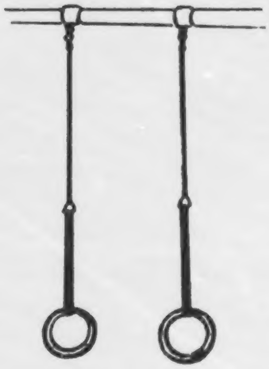
PARALLEL BARS





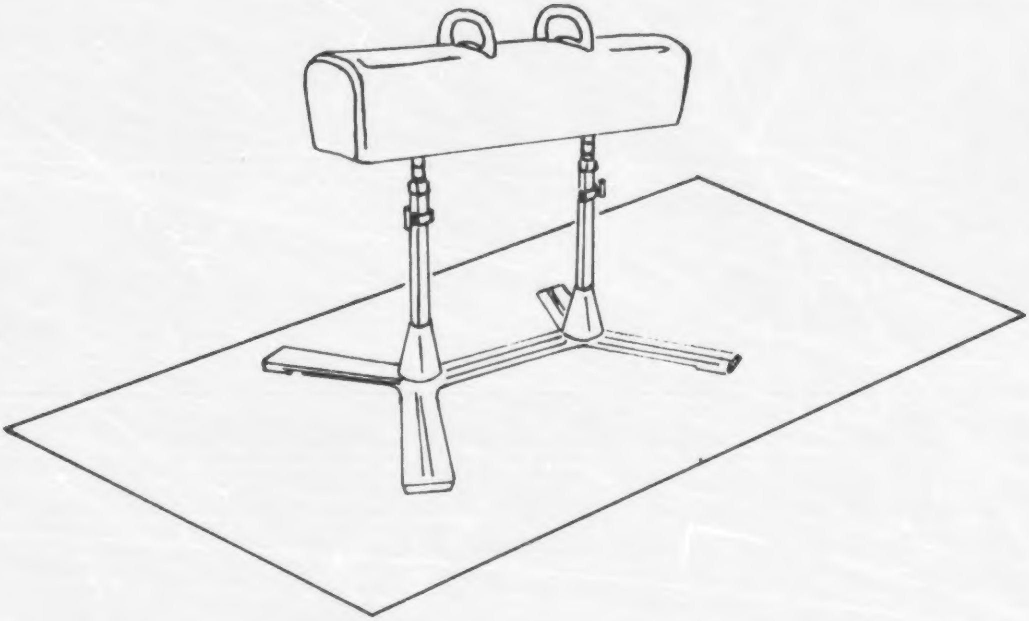
One 6' x 12' fitted mat
Four 5' x 10' panel mats on sides and ends
CLEARANCE: 10' from any obstruction

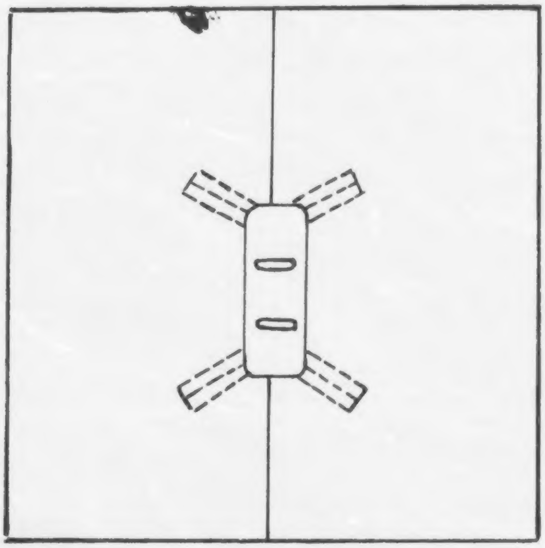
RINGS



Mat 18' x 8'
Mat thickness 6"
CLEARANCE: 12' from any obstruction

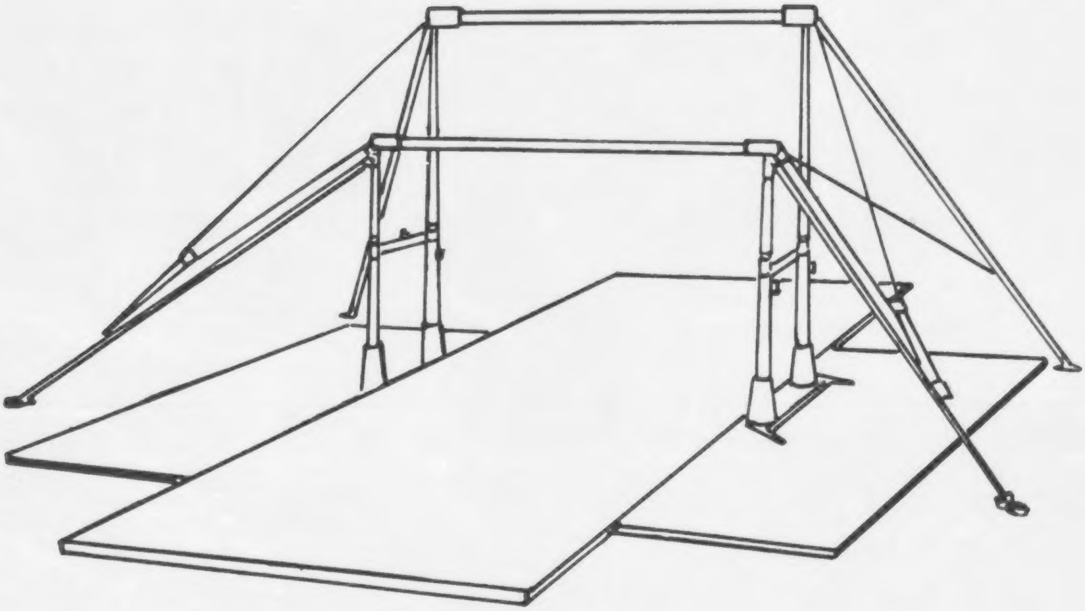
SIDE HORSE

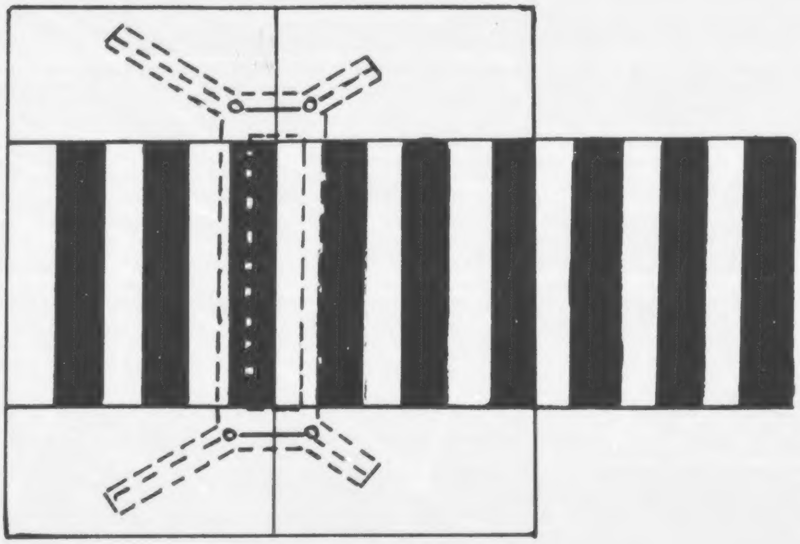




Two 6'x 12' fitted mats butted together
CLEARANCE: Ten feet from any obstruction

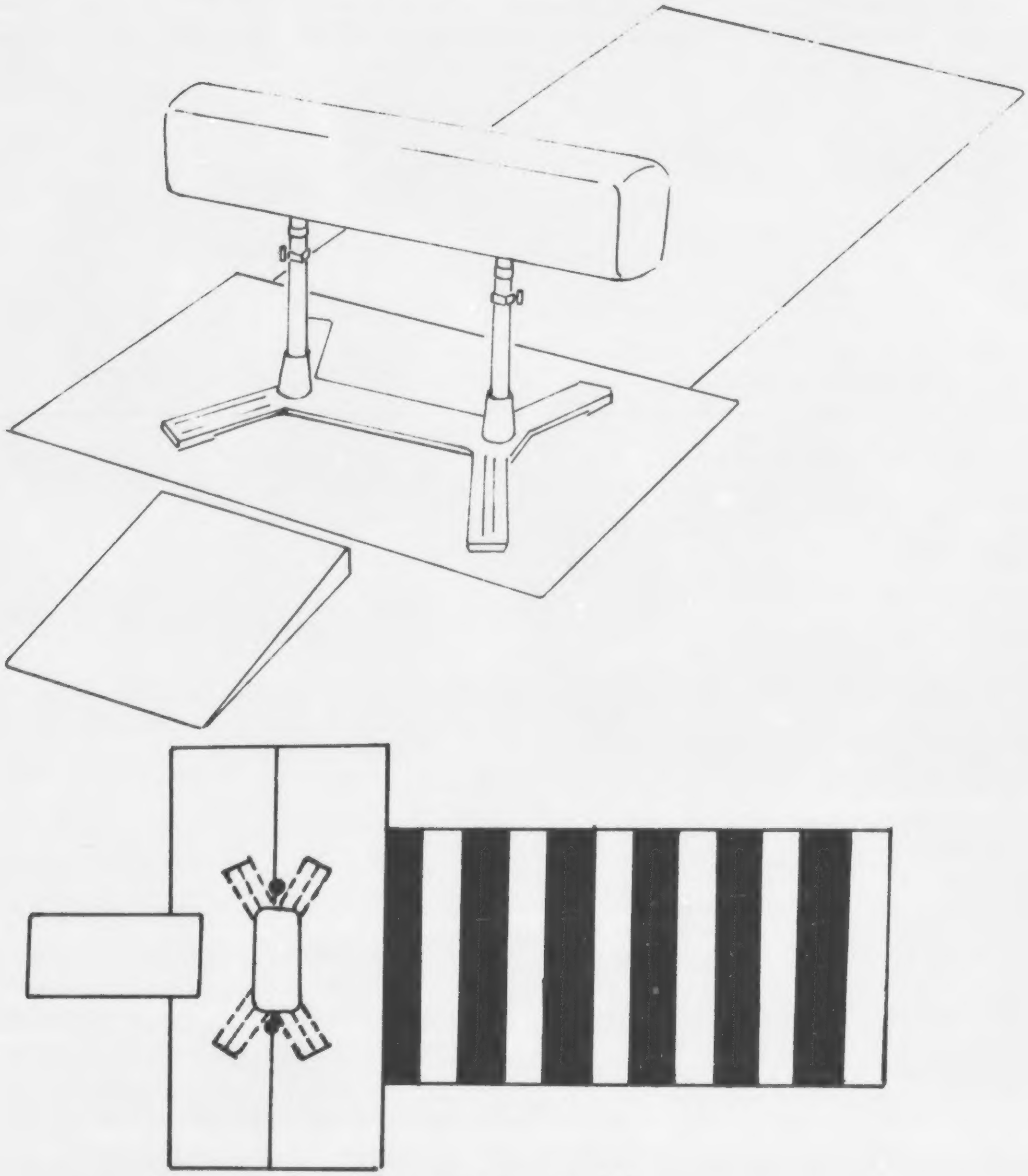
UNEVEN PARALLEL BARS





Two 6' x 12' mats butted together at their side
Two 6' x 12' mats butted together at their ends
CLEARANCE: 16' Front, 12' Rear, 3' Side

VAULTING APPARATUS



Approach area length 50'
Approach area width 5'
Over-all Length 75'
6' x 12' landing mat
5' x 10' double thickness mat around base
CLEARANCE: 20' beyond apparatus

REFERENCES

Materials were selected and reviewed from the following sources, and in some instances were incorporated in the production of the preceding unit.

American Alliance for Health, Physical Education, and Recreation(AAHPER) Sports Safety, Copies available by writing.

Nissen Corporation, Manufacturers of gymnasium apparatus

SCIENCE EQUIPMENT

GENERAL RULES

1. For most educational purposes, lasers with an output of one milliwatt or less should be used.

2. Pressure cookers or autoclaves must have a safety valve in good working order and must be set for not more than 20 pounds maximum pressure.

3. Safety carriers should be used for five pint bottles of: H_2SO_4, HCl, NH_4OH, $HC_2H_3O_2$, and HNO_3.

4. Safety shields or screens should be used whenever there is the potential danger of an explosion or implosion.

5. Mercury light sources are emitters of ultraviolet light. Therefore, pupils using the equipment should be provided with the necessary shielding, and the duration of exposure should be limited.

6. The use of mercury manometers should be carefully regulated. Teachers and pupils should be aware of the danger involved in the absorption of mercury by skin contact or from breathing the vapors from mercury or its compounds.

7. All pieces of apparatus designed to rotate rapidly should be inspected to make certain the spinning device is securely held with a safety lock nut. The apparatus should not be operated at excessive speeds.

8. T-V picture tubes or other large vacuum tubes should not be handled carelessly due to the danger of flying glass from implosions. Goggles should be worn by persons handling such tubes.

9. High voltage DC sources used in experiments such as the "Millikin Oil Drop Experiment" should use a high resistance in series with the output in order to prevent dangerous electrical shock. They should also have a high resistance "bleeder" resistor across the output to discharge the capacitors after the equipment has been turned off.

10. Glassware used for evacuation or low pressure (i.e., for demonstrating the reduction of a boiling point) should consist of new, round-bottomed flasks.

11. When using hypsometers or other types of steam generators, pupils should be cautioned to make certain the steam can escape, and the outlet is not pointed toward any person.

12. Use of obsolete electronic equipment that may utilize high voltage should be carefully scrutinized. Neon sign transformers, radio, and transmitter components may be real hazards to inexperienced pupils.

13. Electrical service in the laboratory must have a three-prong outlet. Conducting (metallic) equipment should be properly grounded. Ground-fault circuit breakers are very desirable for all 120 volt AC circuits in the laboratory. A master switch controlling all laboratory stations should be located in the laboratory room.

14. Gas service for bunsen burners in the laboratory should include a master valve which is readily accessible.

X-RAY - CATHODE RAY

1. All teachers using any type of x-ray equipment should be thoroughly familiar with the potential hazards and take the proper safety precautions.

2. Cathode ray tubes (Crooke's tubes, etc.) should be regarded as possible x-ray emitters in a sporadic fashion.

3. Cathode ray tubes should be used only for demonstrations conducted by the teacher. No pupil should hold the tube while it is operating.

4. Cathode ray tubes should always be operated at the lowest possible voltage. The induction coils should be replaced with those having a solid state voltage regulator since induction coils are frequently subject to spurious excessively high voltage production.

5. Pupils should remain from four to six feet distant from operating cathode ray tubes.

CENTRIFUGE

1. The centrifuge should be used only when the teacher is present to supervise.

2. Pupils should be cautioned about putting fingers, pencils, or other items in the openings where the test tubes belong.

3. Cracked or flawed test tubes should not be used in a centrifuge.

4. The inside of the centrifuge cup should be inspected for rough areas before use.

5. If microorganism cultures are being separated from other substances, a disinfectant solution between the glass tube and the metal cup will help to lessen the possible spread of a harmful organism.

LASER

1. All lasers should be regarded as potentially hazardous to the eyes unless properly handled.

2. Laser demonstrations should be prepared and tested by the teacher when others are not present.

3. The direct propagation of a laser beam from the laser into the eye of an observer should be avoided at all times, regardless of the expected output.

4. One can avoid the danger of a reflected laser beam striking the eyes by removing all unnecessary objects in the path of the beam and by using a dull finish on support rods, etc., that are near the path of the beam.

5. The working area should be kept well lighted at all times when a laser system is in use. This will tend to keep the pupil of the eye relatively constricted and will reduce the amount of light entering the eye in case of accidental exposure.

6. High-powered lasers must not be used in the classroom. The maximum power output should be specified. For educational purposes, 0.5 milliwatt is usually sufficient.

7. Since pupils find lasers very intriguing to manipulate, an operable laser should never be left accessible and unattended.

8. Refer to SECTION X - Personal Protective Equipment.

REFERENCES

Materials were selected and reviewed from the following sources and in some instances were incorporated in the production of the preceding unit.

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3. Fire Protection Guide on Hazardous Materials. Boston, MA: National Fire Protection Association, 1975

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5. Laboratory Waste Disposal Manual. Washington, DC: Manufacturing Chemists Association, revised 1975.

6. Manual of Hazardous Chemical Reactions. Boston, MA: National Fire Protection, 1975

7. The Merck Index. Merck and Co., Inc. Rahway, N.J., 1976.

8. Safety First in Science Teaching, Division of Science, North Carolina Department of Public Instruction, Raleigh, NC., 1977.

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